INTERNATIONAL ABSTRACT OF SURGERY

VOLUME 77 SEPTEMBER, 1943 NUMBER 3

CAROTID-BODY TUMORS

Collective Review

JOHN H. GRATIOT, M.D., F.A.C.S., Monterey, California

DURING the sixty-two years since the first carotid-body tumor was described, not more than 250 cases have been reported, and it is impossible for any one surgeon to have had an extensive experience with these tumors. It is, therefore, not out of place to review this subject, and add 2 cases.

HISTORY

The carotid body was first described as the "ganglion minutum" by von Haller in 1743 and again by Neubauer in 1783. Andersch named it the "ganglion intercaroticum" in 1797. Luschka, in 1862, gave us a histological description to which little has been added. He regarded the body as closely attached to the cervical sympathetic system, in a series with the suprarenal and coccygeal glands and the anterior lobe of the hypophysis. He suggested that tumors might arise from this body twenty-four years before the first case was reported.

The first carotid-body tumor was removed by Riegner in 1880 and described by Marchand in 1891. The carotid artery, jugular vein, and vagus, hypoglossal, and sympathetic nerves were divided with death of the patient on the third day. The second patient, operated on by Maydl in 1886, developed hemiplegia, facial paralysis, and aphasia, but gradually recovered. The third case might be considered the first one successfully treated (Gersuny, 1886). The patient recovered with only slight paralysis of the left vocal cord. Paultauf reported these 2 cases in 1886. All 3 of the patients had section of the common, external, and internal carotid arteries. The next case was the first in which the tumor was removed without ligation of the common carotid by Albert in 1889. The tumor recurred in a year, there was another operation, and the subsequent course is unknown.

Middleton (1895) is given credit for operating on the first case in America. Review of the scanty literature regarding it makes me believe that this was not a carotid-body tumor. The patient had bilateral kernels in the neck following a cold, the right of which persisted and grew for several months. Two months after its removal there was a bilateral recurrence, with death from cachexia at the end of a year. Grossly, the tumor was said to resemble a carcinomatous lymphatic metastasis. There were no microscopic sections, and no autopsy, and the charts and material were destroyed. No subsequently reported case has grown with such rapidity. The growth of these tumors is usually over a period of years rather than months.

Scudder (39) in 1903 reported the first verified American case, a tumor of nine years' duration. The tumor was removed with ligation of the carotid arteries, and the patient recovered. The diagnosis was perithelioma.

Since then about 230 cases have been reported, usually separately as single cases. Few surgeons have seen more than 1 or 2 cases. Harrington, Clagett, and Dockerty (21) reported 19 cases from the Mayo Clinic in 1941, but these were operated upon by different surgeons. Hertzler (1937) has operated on 7 cases and Shawan (1938) on 4 (40). The largest tumor removed (35) weighed 190 gm. (Reid, 1920), although O'Shaughnessy (1931) reported and published a photograph of a tremendous tumor which probably weighed at least that much (31). Unfortunately the weight was not given.

GROSS ANATOMY

The carotid body or gland, which may be absent on one or both sides, is present in all mammals at or near the common carotid bifurcation. The normal human carotid body measures about

5 by 3 by 2 mm., is grayish brown or reddish, homogeneous or lobulated (occasionally divided into separate but connected lobes), and is situated behind the carotid bifurcation. It is usually oblong, its greatest axis is vertical, and it is connected to the carotid bifurcation by a fibrovascular band, the ligament of Mayer. The body is surrounded by a thin fibrous capsule from which connective tissue penetrates the gland and forms septa which divide the parenchyma into lobules. In these septa the blood and nerve supply penetrate the gland. After the age of twenty or thirty the fibrous stroma increases at the expense of the parenchyma (Heinleth).

The arterial supply is from the carotid bifurcation (most often from the external carotid artery), through the ligament of Mayer and entering at the lower pole of the gland. The veins from this organ empty into the superior laryngeal, lingual, and pharyngeal veins, and leave at the upper pole. The carotid body receives nerves from the descending branch of the glossopharyngeal nerve (nervus intercaroticus, carotid sinus nerve of Hering) and the superior cervical sympathetic ganglion, fewer from the vagus and hypoglossal nerves. The sinus nerve arises from the main trunk of the glossopharyngeal nerve, 1 cm. below its emergence from the cranial cavity, and rarely from the pharyngeal branch of the glossopharyngeal nerve, anastomosing during its course down the internal carotid artery with branches from the sympathetic and vagus nerves to form the carotid plexus (Tchibukmacher).

MICROSCOPIC ANATOMY

The parenchyma of the carotid body is composed of large polyhedral, but polymorphic, epithelial-appearing cells with pale homogeneous, faintly granular protoplasm. The cell membrane is faint. The cells contain eccentric round or oval nuclei with a heavy nuclear membrane. They may contain globules due to hyaline degeneration. The nuclei contain chromatin.

The cells may contain granules having an affinity for chrome salts, which stain them brown. This chromaffinity groups this gland with the suprarenal medulla, the para-aortic bodies (Zuckerkandl), and the coccygeal gland, i.e., the paraganglionic or chromaffin system.

These cells are grouped in clusters or alveoli (Zellballen) without lumina, surrounded by delicate connective-tissue strands which penetrate the gland from the capsule, and carry capillaries and nerve fibers.

The capillary net work in the connective tissue is so rich that it has been thought that it formed glomeruli (the parenchymal cells arising directly from the endothelial walls) and that this body was an organ of internal secretion. It has been shown, however, that there is a definite layer of hyalin connective tissue between the capillaries and the parenchymal cells. The capillaries are lined by hyperplastic endothelium. There is no evidence that this gland has an internal secretion.

Both medullated and nonmedullated nerve fibers accompany the connective-tissue bundles, some fibers passing to the parenchymal cells where they end in swollen tendrils.

EMBRYOLOGY

Throughout the years three main theories have been evolved as to the developmental anatomy of the carotid body: it is believed to bud from (1) the epithelium of the pharynx, (2) the endothelium or adventitia of the carotid artery, and (3) the embryonic ganglion cells of the sympathetics (sympathogonia). The latter cells are supposed to be the anlage of the sympathetic and chromaffin systems. It is safe to say that there is still no unanimity of opinion. The explanation of Boyd, quoted by Schmidt and Comroe in 1940 (38), is as follows:

"This is a dual organ from the mesoderm of the third branchial artery and the ectoderm of the glossopharyngeal nerve. It develops in the region in which these two come into earliest juxtaposition. Elements from the sympathetic and vagus come at a late date. It is seen at six weeks, fully developed by ten."

FUNCTION

The function of these glands has long been in doubt. They are not essential to life or to good health. They are apparently not endocrine organs.

Early investigators claimed the production of transient glycosuria followed by gradual cachexia in cats in which the glands were destroyed (Vassale). Another claimed production of osteomalacia in cats by destruction of the glands (Fisher). Another claimed an increase in blood pressure in rabbits in which extract from the carotid body of horses was injected (Monlon). Frugoni in 1913 injected carotid-body extract into rabbits, which caused death within five minutes (probably anaphylactic deaths). These experiments were inconclusive and the results have not been confirmed.

The chromaffin granules have been thought to be epinephrine or precursors of epinephrine, but it has been definitely proved that there is no epinephrine in the carotid gland.

According to Schmidt and Comroe the carotid gland produces effects on the respiration and circulation, which are due to the presence within the gland of chemoreceptors—nerve endings which respond to chemical changes in the arterial blood. The most effective stimuli are asphyxia, anoxia (reduced oxygen pressure in the arterial blood, or poison such as cyanide, which inhibits cell oxidation), acidosis, and drugs with nicotinic properties.

The functions of the carotid body should not be confused with those of the carotid sinus. In several cases of carotid-body tumors (Case I of the author) the carotid sinus has been affected, but the consequent symptoms have been due to the proximity of the carotid sinus and mechanical stimulation. It is remarkable that such a very few carotid-body-tumor cases have produced the carotid-sinus syndrome. Hyperactivity of the sinus is apparently necessary, together with mechanical stimulation, in order that the subject develop this syndrome.

PATHOLOGY

Carotid-body pathology is confined to that of tumors.

Carotid-body tumors are slow-growing, round or oval, and smooth or bosselated growths. On cut section they are grayish red to deep purple, according to the amount of blood they contain. They are homogeneous or finely lobulated. They have well defined capsules which send connective tissue strands into the substance of the growths. Numerous blood vessels are present. These tumors are firm and slightly elastic. They straddle the bifurcation of the common carotid artery. They may surround the common, external, and internal carotid arteries, according to the duration of their growth. They surround the proximal portion of the external carotid artery first, so that it is not unusual to have the internal carotid artery compressed posteriorly by the tumor.

The external carotid artery is sometimes found to be elongated, particularly in that section lying between the superior thyroid and lingual arteries. The posterior portion of the tumor is covered by the upper part of the sternocleidomastoid muscle, which tightens this muscle like a string. The larger tumors extend superiorly to the parotid region, sometimes wedging into the angle between the mandibular ramus and the mastoid process. Medially lies the pharynx, which is displaced by the large tumors, occasionally to the midline. Anteriorly are the angle of the jaw, and the submaxillary and infrahyoid regions. Posteriorly the tumor may extend into the posterior cervical triangle, sometimes pressing on the transverse processes of the cervical vertebrae. The growth may extend any distance inferiorly, even to the clavicle.

These tumors have been called endotheliomas, peritheliomas, neuroblastomas, sympathoblastomas, pheochromoblastomas, pheochromozytomas, angiomas, fibroangiomas, angiosarcomas, perithelial hemangiomas, sympathetic nevi, hamartomas, adenomas, hyperplasias of the carotid gland, paragangliomas, and carotid-body tumors. The last name is probably as good as any, although paraganglioma indicates the relation of these tumors to the entire paraganglionic system—the carotid body, suprarenal medulla, and paraganglionic bodies along the aorta. Four tumors of the Zuckerkandl bodies have been reported. In 1 case there was a malignant tumor of the carotid body with bilateral tumors of the Zuckerkandl bodies along the aorta (Cragg, 1934).

Microscopically these tumors consist of the typical carotid-body polyhedral cells arranged in alveoli or in syncytial masses. The cells are large, and contain faintly granular protoplasm and hyperchromatic polymorphic nuclei. Intracellular globules may be present in those cells which have undergone hyalin degeneration. Between the cell masses are connective-tissue bundles containing capillaries and nerve fibers. The blood vessels may be dilated and cavernous, or may be choked off by the dense fibrous tissue. Leithoff reports a case in which he believed the stroma was sarcomatous. Usually, however, the fibrous stroma does not take active part in the tumor process. The capillaries are lined by prominent endothelial cells which sometimes grow out into the vessels in syncytial buds, or mingle with the chief tumor cells, and produce complex pictures (Ewing 16). Around the alveoli are scattered small undifferentiated cells known as sympathogonia. The cell masses are well enclosed by the fibrous capsule, except in the malignant cases. When malignancy supervenes the capsule is invaded, the alveolar formation is lost, and the cells grow diffusely throughout the tumor. The cells lose their orderly adherence to pattern and run wild.

No epinephrine has been found in the tumors. The cells may contain chromaffin.

Bilateral cases are extremely rare. Of 159 verified cases, 5 were bilateral (Phelps and Snyder, 33). Lund (27) in 1916 removed a tumor from the right side of a patient from whom a left carotid tumor had been removed twenty-nine years previously. Rankin and Wellbrock (34) reported a bilateral case in 1931. De Tarnowsky (1932) reports a case in which a tumor (unverified) of the opposite side had been removed in 1904 (15).

Chase (1933) reported a bilateral case in a patient whose sister had had a carotid-body tumor removed (12). McNealy and Hedin (1939) reported a bilateral case in a patient whose brother presumably had had a carotid-body tumor (28).

The weight of the tumors has not been recorded in most cases. Reid (1920) reported a tumor weighing 190 gm. (35), and Keen and Funke one weighing 100 gm. (25). Shawan and Owen (40) removed a 90 gm. tumor. One of the author's weighed 66 gm. By far the majority of the reported tumors weighed less than 50 gm.

Probably from 15 to 20 per cent of carotid-body tumors become malignant. They remain benign for years and then are only locally malignant. Distant metastases are rare, or may not occur. No case with distant metastases has been verified. Gilford and Davis reported metastases to the liver, but it is very doubtful that they were from a carotid-body tumor. Rankin and Wellbrock (34) reported 2 cases from the Mayo Clinic in which there may have been brain metastases (one patient had signs of a brain tumor, the other epilepsy). Neither was confirmed. The only verified cases of metastases have been in the regional lymph nodes.

ETIOLOGY

The cause of these tumors, as of other tumors, is unknown. Patients vary in age from seven to seventy-three years, most of them being between the ages of 25 and 60 years. Both sexes are equally susceptible. Negroes are affected as well as white people. Occupation seems to have no bearing on their development. Several familial cases have been reported, as mentioned. Peterson and Meeker point out that the bilateral occurrence, the occasional familial incidence, and the case of coincident carotid and aortic paragangliomas suggest systemic or hereditary factors.

It is remarkable how often intrabuccal inflammatory conditions precede or call attention to these tumors. Von Heinleth mentions a case following tooth extraction with formation of an abscess. Several have been mentioned as following influenza or tonsillitis. However, these tumors are of such slow growth that they have often been present for a long time before they are noticed. They are often first diagnosed as enlarged lymph nodes. If tonsillitis or similar intrabuccal inflammation occurs, it is quite natural to assume that this caused the enlargement which had not been previously noticed.

SYMPTOMS

In most cases symptoms are remarkably few. The most usual, and often the only symptom is the presence of a swelling below and behind the angle of the jaw. This has probably been present for years, has grown very slowly, or has suddenly taken on a spurt of growing in the past few months; this accelerated growth brings the patient to the doctor.

Other symptoms, which are not usual, are due to pressure of the tumor on nearby structures. These are hoarseness, cough, dysphonia (recurrent laryngeal-nerve pressure); dilatation or constriction of the pupil, with or without narrowing of the palpebral fissure (cervical sympathetic pressure); nausea, vomiting, tachycardia, abdominal pain, constipation (vagus pressure); ringing or roaring in the ear, headache (possibly due to vascular compression); local pain, or pain in the arm or shoulder (sensory-nerve pressure); and dyspnea, dysphagia (pressure on larynx, trachea, and esophagus). Facial and dental pain have been mentioned. These symptoms may occur in varying degrees, but in most cases are absent.

In a very small number of cases, perhaps 3 per cent, various manifestations of the carotid-sinus syndrome occur. With the intimate anatomical relation of the tumor and the carotid sinus, it is indeed remarkable that this syndrome is not seen more frequently in these cases. Apparently it is necessary to have a hypersensitive sinus as well as a tumor. This syndrome may occur on mechanical stimulation in anyone with a hypersensitive carotid sinus. A tumor is not necessary. The syndrome is caused by a reflex from the sinus nerve. This reflex proceeds through one of three routes, each of which gives a different response (Weiss, Capps, and Ferris, 49):

1. Vagal route. The symptoms are due to vagus stimulation with cardiac asystole, sinoauricular or auriculoventricular block, and fall in the blood pressure, which result in dizziness and faintness. These symptoms are prevented by the subcutaneous administration of epinephrine and relieved by the intravenous injection of atropine.

2. Depressor nerve route. The symptoms are due to vasodilatation with fall in the blood pressure and cerebral anoxia. They are relieved with epinephrine.

3. Cerebral type. The impulse goes directly to the medulla and hypothalamus. Atropine and epinephrine are of no benefit.

Symptoms attributable to the carotid-sinus syndrome are dizziness, weakness, faintness (usually in the upright position), spots before the eyes, epigastric distress, and unconsciousness. The author's first patient had increasingly frequent spells of momentary blindness accompanied by faintness, nausea, trembling, and excessive pers-

piration, each spell being followed by two hours of frontal and occipital headache. The spells always came on when she was in an upright position.

PHYSICAL FINDINGS

Until the tumor attains an appreciable size, inspection shows nothing to indicate its presence. Extension of the head with a light shining in a tangential direction to the skin may show a swelling behind and below the angle of the jaw. This may be wholly or partially covered by the upper portion of the sternocleidomastoid muscle. The tumor is raised synchronously with the pulse, by the carotid arteries. It does not have an expansile pulsation as does an aneurysm.

Reid (35) describes 2 cases with pigmentary changes in the skin, both of which cleared up after removal of the tumor. One patient had an erythematous flush over the neck, suffusion of the face, and a yellowish dark color of the entire body. The other had a lemon-yellow color of the entire body. These pigmentary changes must be rare, or perhaps they are frequently overlooked.

If the tumor is large enough the pharyngeal wall may be seen to bulge toward the opposite side, pushing the tonsil, soft palate, and uvula before it.

The tumor may be palpated when the sternomastoid muscle is relaxed by placing one hand behind the muscle and pushing the tumor forward. It lies between this muscle, the larynx, and the thyroid cartilage, sometimes extending superiorly to the parotid and mastoid regions, posteriorly into the posterior cervical triangle and to the vertebral column, and inferiorly toward the clavicle for a variable distance. The tumor may also be palpated bimanually by placing the fingers of one hand in the mouth and pushing the pharynx and tumor outward. It is oval or round, smooth or slightly lobulated, firm and slightly elastic. In some instances it can be momentarily compressed by squeezing a portion of the blood out of it. The transmitted pulsation from the carotid arteries can be elicited by palpation, the pulsation ceasing when the common carotid artery is compressed below the tumor. There is some lateral mobility to the carotid trunk, consequently to the tumor, but no vertical mobility. When the tumor is large enough to be wedged into the mastoid-mandibular angle there is mobility in no direction. Reid (35) says "There is no other growth of the neck which catches, fixes, and carries the carotid artery with it." The tumor, unless malignant, is not adherent to the skin or muscles. Occasionally there is some tenderness on pressure, rarely a thrill.

Reclus and Chevassu have described a sign which is probably of doubtful value. If the tumor is pushed toward the pharynx, the carotid artery is angulated, its convexity toward the pharynx. The tumor seems to disappear and reappears only after the pulsations straighten the artery.

Auscultation rarely reveals a bruit or murmur, it is usually entirely negative.

LABORATORY FINDINGS

The laboratory is usually of little help in establishing a preoperative diagnosis. Blood and urine findings are normal. X-ray findings are negative. So far as I know, arteriography has never been attempted in these cases.

Greene and Greene (19) advocate a needle-puncture biopsy with devitalization of any possible malignant cells which may be in the track of the needle by means of an outer insulated steel sheath through which runs a high-frequency current.

DIFFERENTIAL DIAGNOSIS

There is no way to make an absolute preoperative diagnosis of carotid-body tumor except by punch or aspiration biopsy, which procedure is not without danger. A correct diagnosis aids tremendously in giving the patient the best chance of cure: the surgeon is better able to plan his operative procedure; the gravity of the situation and the prognosis can be explained to the patient or to his family; and systematic preoperative carotid compression can be practiced if desirable.

A carotid-body tumor is a single, solid, slow-growing tumor intimately attached to the carotid bifurcation. No other growth fulfils all these qualifications.

An aneurysm of the carotid artery has an expansile pulsation, not one merely transmitted from the underlying arteries. The aneurysm is more compressible. A bruit is rarely heard in either.

Metastatic malignancy is much more rapid in growth, is usually not single or smooth, and is stony hard. The head, nose, sinuses, and buccal cavities should be thoroughly examined in all cases of neck tumor.

The malignant lymphomas are usually multiple, are present in lymph nodes elsewhere in the body, and often show blood changes. The deep cervical lymph nodes accompany the internal jugular vein, lateral to the carotid artery.

Inflammatory lymph nodes originate from a primary focus; the process is of short duration unless granulomatous. The nodes are usually multiple, tender, and lie in the lymph nodes rather than in the carotid bifurcation.

Abberant thyroid tissue may be difficult or impossible to differentiate, but it is unusual to find it exactly at the bifurcation with all the other carotid-body-tumor characteristics.

Branchial-cleft cysts are more superficial, softer, and usually quite moveable. Aspiration often shows cholesterol crystals.

Branchiogenic carcinoma is superficial to the carotid artery, and is stony hard.

Thyroglossal-duct cysts are usually in the midline of the neck rather than on the side, are cystic, and should offer no difficulty in differentiation.

Other lesions which may rarely cause difficulty in diagnosis are lipoma, sarcoma, fibroma, lues, tuberculous nodes, hygroma, pharyngeal diverticulum, neurofibroma, and ganglioneuroma.

The fact remains that it is impossible to diagnose some growths before they have been exposed at operation. As Hertzler says, every neck tumor should be accurately diagnosed, even if this necessitates exploration.

TREATMENT

There is practically universal agreement that the treatment of these tumors is surgical excision. Many authors state that x-rays or radium may be effective. This belief arose from the fact that Bevan and McCarthy, in 1929, reported a case cured by x-rays (5). This tumor was exposed at operation, but there was no biopsy. Thirteen months after operation the patient had had 14 x-ray treatments, and the mass had nearly disappeared. I know of no follow-up on this case. As far as I am aware, this was the only case ever benefited by radiation, and it was unconfirmed. Phelps and Snyder (33) mention 7 cases treated with x-rays or radium without benefit. Stewart (1931) reported a malignant case in which a large dose of radium administered through skin punctures reduced the size of the tumor temporarily, but repeated radiation was of no value (44). Radiation does not usually affect a slow-growing, well differentiated growth with a fibrous capsule.

Bevan and McCarthy (5) were strong in their feeling that excision should not be practiced if common-carotid ligation was necessary to accomplish this. I do not believe this can be applied dogmatically to all cases. Young people usually tolerate carotid ligation fairly well. In cases with pressure symptoms or with repeated syncopal attacks it is often imperative that the risk of carotid ligation be taken. A tumor which has recently taken on rapid growth usually necessitates acceptance of this added risk, should this be necessary.

Several ingenious devices have been used for gradual compression of the carotid artery, in order to establish a collateral circulation to the cerebrum: metal bands (Halsted), fascia (Matas), a clamp which can be gradually closed (Crile), and a clamp whose blades come together as the surrounding catgut is gradually absorbed (Neff). The use of these devices does not seem to influence the morbidity or mortality following ligation. It has been suggested that the carotid artery be manually compressed for increasing periods of time for several weeks before surgery. There has been no comparative series reported showing morbidity and mortality with and without compression, but it seems to me that this must be a rather ineffectual procedure. It is most likely that the patients with normal vessels and an efficient collateral circulation will tolerate ligation; conversely, those with hardened arteries and without a sufficient collateral circulation will not tolerate it, regardless of preoperative compression.

The treatment of this lesion should be individualized. No doubt a few of these cases require no treatment. If the tumor is small, and is causing no symptoms, particularly if the patient is elderly, observation might be carried out and operation performed only if rapidity of growth or pressure-symptoms supervened. Most of the growths however, will require surgical attack.

Local anesthesia seems to be the choice of most surgeons. I used a general anesthetic in my cases and recommend it. These are often long procedures. When a general anesthetic is used one can work rapidly and there is no discomfort to the patient. Deep anesthesia is not necessary. One of my patients had had repeated carotid-sinus-syndrome symptoms, but took a perfectly smooth anesthetic.

A generous incision should be made along the anterior border of the sternocleidomastoid muscle, and the muscle retracted posteriorly after it is dissected from the underlying carotid sheath. Usually there is greatly increased vascularity in this region, necessitating the ligation or electrocoagulation of many small vessels. The carotid sheath is then opened to expose the internal jugular vein, carotid artery, and tumor. The internal jugular vein is often adherent to the tumor and must be divided (this can be done with impunity). The common-carotid artery should be well exposed proximal to the tumor, and a ligature placed around it but not tied. This provides a safety device in case of unforseen opening of the vessel during dissection of the tumor. The vagus and sympathetic trunks must be kept in mind at all times. These are situated within the carotid sheath, between the carotid artery and internal jugular vein.

The hypoglossal nerve should be identified near the upper part of the tumor.

If the tumor is small enough so that the external, internal, or common carotid arteries are not surrounded by it, removal is comparatively easy. Unfortunately such is not the case by the time most of them come to operation.

The encapsulated tumor should then be dissected from the surrounding tissues as far as possible. This is usually a slow, meticulous procedure, and extreme vascularity is encountered.

When the tumor has been separated on all sides, an attempt should be made to separate it from the large vessels. This can sometimes be done by carefully inserting a clamp along the vessel from below (as one sometimes separates the thyroid isthmus from the trachea), then dividing the overlying tissue between clamps, and repeating this until the entire vessel is exposed. This is a slow procedure, but well worth the extra time involved. The tumor can then be dissected from around the entire vessel, drawn out, and removed. As so few of these tumors are malignant, there is no harm in opening into the tumor or in removing it in two or more sections, provided the entire capsule and all sections are removed.

In some cases it is impossible to dissect the tumor from the arteries. In these cases one must balance the risk of carotid ligation against that of not removing the tumor, and decide whether or not to proceed. Carotid ligation makes the remainder of the operation comparatively easy. In ligating the common-carotid artery it is important not to include the vagus nerve in the ligature, also to transfix as well as ligate the proximal stump of the artery.

After common-carotid ligation the tumor can be dissected and drawn out of its bed from below upward, the internal and external carotid being ligated and transfixed above the growth. This lifting up of the tumor gives exposure of the vagus nerve.

In closing the wound the cervical fascia and skin should be sutured and a rubber-dam drain placed in the lower angle of the wound to permit the escape of serum.

As these operations are such long procedures it is sometimes well to divide them into two stages from ten to twenty days apart. I believe that there is one big advantage to a two-stage operation—the reaction from the first stage causes thrombosis of many minute blood vessels, and there is much less vascularity present during the second stage. The first stage might well be terminated after the tumor has been separated on two or more sides from the surrounding tissue.

The most frequent postoperative complications are pneumonia, cerebral anemia with its various manifestations (hemiplegia, aphasia, unconsciousness), shock, hemorrhage, paralysis of the vocal cords, dysphasia, tongue deviation (hypoglossal injury), and facial paralysis.

The most common causes of death are pneumonia, hemorrhage, and cerebral anemia. The mortality rate as given by most authors is from 10 to 20 per cent without, 30 per cent with, common-carotid ligation. It is interesting that common-carotid ligation has been necessary in only 50 per cent of the cases during recent years, from 1928 to 1937 as opposed to 82 per cent from 1880 to 1920. I have no doubt that this can be lessened still further by more careful and meticulous dissection.

Recurrence occurs in about 7 per cent of the patients who survive the operation (Phelps and Snyder, 33). These recurrences are undoubtedly in cases in which the entire capsule and tumor were not removed. Probably about a quarter of all patients who survive surgery have some residual symptoms due to injury of the adjacent structures or to various degrees of cerebral thrombosis.

CASE REPORTS

CASE 1. M.W., a thirty-eight-year-old white, American housewife, entered the Monterey County Hospital on June 5, 1939, complaining of a swelling on the left side of the neck of four years' duration. Six years before entry she noticed a burning sensation in the throat. Soon she began to have attacks of nausea, momentary blindness, faintness, trembling, and excessive perspiration. These attacks occurred every four to six weeks, each lasting about an hour. Four years before entry she had a tonsillectomy, the left tonsil being much the larger. At that time she noticed a lump behind and below the angle of the left jaw, which her doctor thought was a lymph node. This had since grown steadily until her head was tilted to the right. During the year before entry the lump had grown with great rapidity. The attacks increased in frequency as the tumor grew. Two years before her admission to the hospital they occurred twice a week and during the year before entry about five times a week. All attacks came on when she was in an upright position and were followed by frontal and occipital headache for two hours. When she was lying down she had a roaring in the left ear. She had increasing dysphagia. There was no pain. The family and past history was irrelevant.

Examination showed a thin woman with her head held well to the right side. There was a large firm, smooth, nontender tumor beneath the left sternomastoid muscle (Figs. 1 and 2). It extended from the mastoid process to below the level of the thyroid cartilage, into the posterior cervical triangle, and well forward beneath the ramus of the mandible. Internally the tumor displaced the pharyngeal wall, soft palate, and uvula far to the right. There was no thrill or bruit. There was transmitted pulsation from the great vessels. The tumor was so large and so firmly wedged between the mastoid process and mandible that mobility was absent. The heart and lungs were normal. The blood

Fig. 1. Left, Case 1 between first and second stages of the operation. Note tilting of head to right by this large carotid-body tumor on the left side.

Fig. 2. Case 1 three years following removal of the tumor.

pressure was 120 systolic and 80 diastolic. Abdominal, pelvic, and neurological examinations were negative.

The blood count and urine tests were normal. The Wassermann test was negative.

The preoperative diagnosis was designated as carotid-body tumor.

The first operation was performed June 6, 1939. Under general anesthesia an incision was made along the anterior border of the sternomastoid muscle, from the mastoid process to the level of the thryroid gland. The sternomastoid muscle was exposed and retracted posteriorly, the cervical fascia being divided over the tumor. As the sternomastoid muscle was stretched like a ribbon over the tumor, it was divided transversly to facilitate exposure. The tumor capsule was extremely vascular and covered by innumerable small vessels. The internal jugular vein was densely adherent to the tumor, which necessitated its removal. It was likewise necessary to sacrifice the hypoglossal nerve. By meticulous division and ligation of the many small vessels the tumor was slowly dissected free anteriorly and posteriorly. The external carotid artery, which pierced the anterior part of the tumor, was gradually isolated by dividing the tumor over it. I then decided to postpone the remainder of the dissection until another stage. The wound was closed, and a rubber-dam drain was left at the lower angle.

The second operation was done June 19, 1939. The wound was opened and to further increase exposure a transverse incision was made below the mandibular ramus. The sternomastoid muscle was again divided transversely. The tumor was divided over the external and internal carotid arteries, which vessels were thoroughly exposed and freed from the tumor. Dissection was much easier at this stage than at the previous one because of the thrombosis of the small blood vessels. The circumference of the tumor was then dissected from the surrounding tissue. The upper portion was wedged into the angle between the mandible, mastoid process, and cervical vertebrae, which made removal difficult at this point. The tumor was entirely removed without sacrifice of the great vessels, and the wound was closed as previously.

The postoperative course was uneventful until the fourteenth day when the patient showed signs of pneumonia in the base of the left lung. This rapidly subsided. The wound developed a superficial infection (staphylococcus albus), which cleared up in short order. The patient was discharged five weeks after the second operation.

She has had no further nausea, tinnitus, headache, or faintness. Swallowing returned to normal and the pharyngeal swelling decreased so that the uvula is in the midline. The patient has gained greatly in weight and strength. The left side of the tongue is paralyzed, as is the left vocal cord, but this handicaps her very little. She was last seen on January 17, 1943, at which time she considered herself perfectly well. There was no sign of recurrence.

The tumor (Fig. 3) was encapsulated, bosselated, firm, and reddish brown on cut section. It measured 7.5 cm. by 5.5 cm. by 3.5 cm., and weighed 56 gm. Histological examination by McNaught was as follows (Fig. 4):

There is a fibrous tissue net work containing many spaces filled with cells of rather uniform size and staining qualities. These cells have moderately arge oval nuclei, stained deeply, and show no mitotic figures. Between masses of these cells are many capillary spaces. There are also many cavernous blood spaces, greatly resembling cavernous angiomas. There are buds of connective tissue which extend out into the lumen of some of the cavernous sinuses. The histological picture is typical of that described for carotid-body tumor.

CASE II. C. T., a twenty-seven-year-old white American salesman, entered the Peninsula Community Hospital, Carmel, California, on December 29, 1939.

Four years previously he noticed a lump as large as the end of his little finger behind and below the angle of the left jaw. This gradually but steadily grew larger, more rapidly during the six months before admission. There

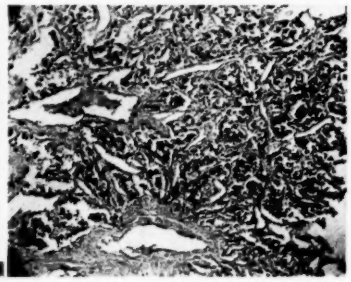

Fig. 3. The tumor removed from Case 1.

Fig. 4. Section of tumor shown in Figure 3 (low power). Note extreme vascularity.

were no subjective symptoms except for a choking sensation when he lay on his left side, during the month before entry. There was no vertigo, fainting, or other pressure symptom.

On September 12, 1937, (two years before this admission) under the impression that this was a branchial-cleft cyst, I had made a transverse incision over the tumor, under local anesthesia. An extremely vascular tumor was encountered, which necessitated cessation of the operation after a small biopsy was obtained. This proved to be a carotid-body tumor.

Four months later an attempt was made elsewhere to remove the tumor, but the vascularity again forced the surgeon to stop without removing any of the tumor.

At this entry physical examination was entirely negative except for the left cervical region. Immediately inferior and posterior to the angle of the mandible there was a smooth nontender mass about 8 cm. in diameter, overlapped posteriorly by the sternomastoid muscle, and extending inferiorly for about 1 cm. below the level of the thyroid cartilage (Fig. 5). The tumor could be moved slightly horizontally, but not vertically. It was very slightly compressible, but immediately filled with blood after the release of pressure. There was no thrill or bruit. The pharyngeal wall was not displaced. There were scars of the previous operation. The blood pressure was 110 systolic and 70 diastolic.

The laboratory findings were all noted to be within normal limits.

The preoperative diagnosis (confirmed by previous biopsy) was carotid-body tumor.

Operation was performed on December 30, 1939. Under avertin and inhalation anesthesia an incision 8 cm. in length was made along the anterior border of the sternomastoid muscle. This muscle was separated from the underlying carotid sheath and tumor after the division of innumerable small blood vessels. The carotid sheath was then incised, the common-carotid artery isolated inferior to the tumor, and a chromic catgut ligature placed around it but not tied.

The tumor was then meticulously dissected posteriorly. This was slow work and the vascularity necessitated temporary packing on several occasions, as the bleeding points could not be identified until the tumor had been further freed. Anteriorly the dissection was carried out in a similar fashion. Above, the posterior belly of the digastric muscle and the hypoglossal nerve were identified.

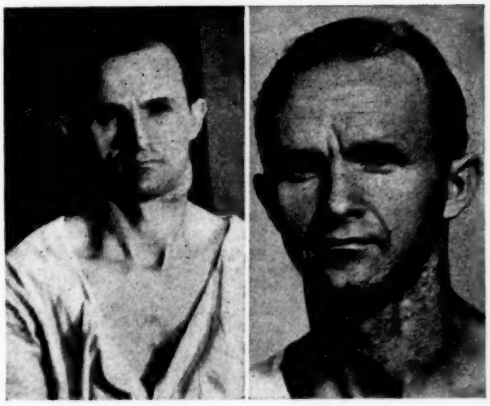

Fig. 5. Case 11, the patient as he appeared before operation.

Fig. 6. Case 11 fourteen months after operation. Anteriorly placed scar of previous unsuccessful operation can be seen. Scar of last operation is barely seen along the anterior border of the sternocleidomastoid muscle.

An attempt was then made to dissect the tumor from the carotid vessels, but it was soon apparent that violent hemorrhage precluded this. The common-carotid artery was ligated with a double ligature of No. 2 twenty-day chromic catgut below the tumor. Two clamps were placed across the vessel above the ligature and the artery was divided between. There was no change in the patient's condition and the temporal artery continued to pulsate. The stump of the common carotid was then transfixed with chromic catgut. The internal jugular vein was quite adherent to the carotid artery; it was likewise divided. The tumor was lifted from its bed in the carotid sheath and dissected superiorly. Ligation of the common carotid artery naturally facilitated this immensely. The internal

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 7. The tumor removed from Case 11.

Fig. 8. Low-power section of tumor shown in Figure 7. Note the well defined capsule, the fibrous stroma, and the alveolar arrangement of the cells.

Fig. 9. High-power section of the tumor shown in Figures 7 and 8.

and external carotid arteries were divided and ligated above the tumor, and the latter was removed. All bleeding points were ligated, the cervical fascia was sutured to the anterior edge of the sternomastoid muscle, a rubber-dam drain was placed to the lower angle of the wound, and the skin was closed.

The postoperative course was uneventul. The wound healed well. The patient complained of slight pain above the inner angle of the right eye for five days, but had none since. There was no vertigo or gastrointestinal symptom. The neurological findings were entirely normal.

This man has remained in excellent health during the three years since operation, has lost no time at work, and has had no subjective or objective neurological or psychological changes. There is no evidence of recurrence (Fig. 6).

The tumor (Fig. 7) was well encapsulated, measured 6 cm. by 5 cm. by 4 cm., and weighed 32.5 gm. It was firm, slightly compressible, and reddish grey on section. Both the capsule and tumor were very vascular.

The results of histological examination by Wood were as follows (Figs. 8 and 9):

The tumor is composed of rather coarse honeycombed fibrous stroma, which supports thin-walled congested blood vessels. The spaces formed by the stroma are filled by rather large uniform-appearing polyhedral-shaped cells; these possess oval nuclei with finely reticulated chromatin, the cytoplasm of which is finely granular and slightly eosinophile. Mitotic figures are extremely rare. The histological structure is typically that of a benign carotid-body tumor.

SUMMARY

A review is presented of the history, anatomy, embryology, physiology, and pathology of the carotid body and the carotid-body tumor. The clinical course, diagnosis, and treatment of these tumors is discussed. Two additional cases of carotid-body tumor are presented.

BIBLIOGRAPHY

1. Abbott, A. C., and Stephenson, E. J. Am. M. Ass., 1934, 103: 21.
2. Abe, T. Gann, Tokyo, 1925, 18: 80.
3. Anquez, E. E. P. Internat. Clin., 1920, 3: 208.
4. Balfour, D. C., and Wildner, F. Surg. Gyn. Obst., 1914, 18: 203.
5. Bevan, A. D., and McCarthy, E. R. Surg. Gyn. Obst., 1929, 49: 764.
6. Bodine, M. W. Pennsylvania M. J., 1930, 34: 17.
7. Bonikowsky, H. Zbl. Chir., 1926, 53: 2449; abstract in J. Am. M. Ass., 87: 2041.
8. Boot, G. W. Ann. Otol. Rhinol., 1923, 32: 1241.
9. Bowen, W. F., and Miller, M. B. J. Kansas M. Soc., 1926, 26: 321.
10. Budge, W. H. California West. M., 1929, 31: 423.
11. Callison, J. G., and Mackenty, J. E. Ann. Surg., 1913, 58: 740.
12. Chase, W. H. J. Path. Bact., Lond., 1933, 36: 1.
13. Cragg, R. W. Arch. Path., Chic., 1934, 18: 635.
14. Da Costa, J. C. Ann. Surg., 1906, 44: 393.
15. De Tarnowsky, G. Am. J. Surg., 1932, 18: 261.
16. Ewing, J. Neoplastic Diseases, p. 384. Philadelphia: W. B. Saunders Co., 1940.
17. Fellerman, J. L., and Pritchard, W. H. J. Am. M. Ass., 1939, 112: 1317.
18. Gordon-Taylor, G. Brit. J. Surg., 1924, 28: 163.
19. Greene, E. J., and Greene, J. M. Am. J. Surg., 1933, 22: 521.
20. Guthrie, D. J. Lar. Otol., Lond., 1924, 39: 635.
21. Harrington, S. W., Clagett, O. T. and Dockerty, M. B. Ann. Surg., 1941, 114: 820.
22. Harvey, F. Brit. J. Surg., 1928, 16: 163.
23. Joyce, T. M., and Drack, S. L. Surg. Clin. N. America, 1934, 103:21.
24. Keegan, J. J. Surg. Gyn. Obst., 1933, 57: 368.
25. Keen, W. W., and Funke, J. J. Am. M. Ass., 1906, 47: 469, 566.
26. Knighton, J. E. N. Orleans M. & S. J., 1926, 26: 321.
27. Lund, F. B. J. Am. M. Ass., 1916, 69: 348.
28. McNealy, R. W., and Hedin, R. F. J. Internat. Coll. Surgeons, 1939, 2: 285.
29. Miller, R. H., and Garland, F. E. Boston M. & S. J., 1924, 101: 651.
30. Nix, J. T., and D'Aunoz, R. Am. J. Surg., 1931, 13: 529.
31. O'Shaughnessy, L. Brit. J. Surg., 1931, 19: 153.
32. Peterson, E. W., and Meeker, L. H. Ann. Surg., 1936, 103: 554.
33. Phelps, F. W., and Snyder, G. A. C. West. J. Surg., 1937, 45: 42.
34. Rankin, F. W., and Wellbrock, W. L. A. Ann. Surg., 1931, 93: 801.
35. Reid, M. R. Bull. Johns Hopkins Hosp., 1920, 31: 177.
36. Royster, H. A. South. M. J., 1924, 17: 196.
37. Russell, H. Edinburgh M. J., 1942, 49: 366.
38. Schmidt, C. F., and Comroe, J. H., Jr. Physiol. Rev., 1940, 20: 115.
39. Scudder, C. L. Am. J. M. Sc., 1903, 126: 384.
40. Shawan, H. K., and Owen, C. J. Am. J. Surg., 1938, 40: 462.
41. Shipley, A. M., and Lynn, F. S. J. Am. M. Ass., 1916, 66: 1602.
42. Smith, C. Am. J. Anat., 1925, 34: 87.
43. Sonck, C. F. Surg. Gyn. Obst. (Internat. Abstr. Surg.), 1938, 66: 518.
44. Stewart, H. H. Brit. J. Surg., 1931, 19: 114.
45. Stewart, Q. Edinburgh M. J., 1928, 35: 214.
46. Sullivan, R. P., and Fraser, A. Surg. Gyn. Obst., 1927, 45: 209.
47. Tchibukmacher, N. B. Surg. Gyn. Obst., 1938, 67: 740.
48. Traut, E. F. Surg. Gyn. Obst., 1927, 45: 829.
49. Weiss, S., Capps, R. B., Ferris, E. B. Jr., and Munro, D. Arch. Int. M., 1936, 58: 407.
50. Winslow, R. Ann. Surg., 1916, 64: 257.
51. Wright, L. F., and Mazner, M. Am. J. Surg., 1938, 41: 103.

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Cairns, H.: Planning for the Treatment of Head Injuries. *Brit. M. J.*, 1943, 1: 313.

The picture of late results of head injuries has been painted blacker than it is. Among a series of 237 patients with acute head injuries in the fighting services it was found that 80 per cent returned to duty, the majority within three months. Among a series of 158 civilians 25 per cent returned to work within three weeks, 50 per cent between three and nine weeks, and only 8 patients had not returned to work within six months. These are the results in unselected hospital material from a mixed urban and rural area, at a time of comparatively standardized and favorable social conditions. In the series of civilian injuries only 2 patients had permanent incapacitating brain damage.

About 30 per cent of the patients with head injuries have severe injuries in other parts of the body. All fresh head injuries are best treated in the traumatic service of a general hospital. Those patients needing a neurosurgeon, either because of severe brain injury or failure to recover according to expectations, should be transferred to head-injury centers when it is feasible.

More precise knowledge of the number, type, and distribution of accidents is needed to aid in the planning of traumatic services and head-injury centers. In England in 1935, about 10 per cent of 1,300,000 injured were treated as in-patients. The percentage of head injuries varies from one type of accident to another. Of patients admitted to the Radcliffe Infirmary—mainly victims of road accidents—30 per cent showed head injuries. In the United States about 7 per cent of the patients in industrial accidents have head injuries.

The accident surgeon should have a clear understanding of the problems of treatment and rehabilitation of patients with head injuries. In addition to the repair of scalp wounds, operation is required in about 5 per cent of the cases. In the cases reported, methods of treatment were simple and did not include dehydration. The patient was allowed to get up gradually, soon after he had regained consciousness. He was given a thorough neurological examination and his personality was assessed by a study of his past, social, and family histories. An important part of the treatment was reassurance of the patient as well as of his family. For patients from the fighting Services occupational therapy and graduated physical training were employed. In civilian cases no such measures were used. The patient was discharged to his home soon after he was able to get about, with instructions to report to the out-patient department a little before the time at which it was estimated he might be fit to return to work. The patient was advised to take graduated exercises of his own choice. Difficulties of a psychological or social character were dealt with by explanation and reassurance, and by visits of the social worker to the home or to the employers. Psychological management appears to be very important in the majority of the cases. This form of treatment is best given by the physician who has treated the patient from the beginning.

DAVID J. IMPASTATO, M.D.

Lambros, V. S.: Repair of Large Cranial Defects. Report of a Case in Which a Large Cranial Defect was Repaired with a Graft from the Ilium. *Arch. Surg.*, 1943, 46: 575.

A case is reported in which a large defect of the skull was repaired by the utilization of almost the entire outer table of the ilium. There was only temporary impairment of function of both the pelvic bone and its attached muscles. The patient, following operative removal of a psammomatous meningioma and hyperostotic bone, had a large cranial defect in the frontal region. The defect was exposed at a second operation and a rubber patch was shaped to fit the defect. A horseshoe-shaped incision along the crest of the ilium was made, with limbs extending downward 4.5 cm. from the anterior and posterior iliac spines. The muscles were stripped from the entire side of the ilium, and the patch of rubber tissue fitting the skull defect was laid on the side of the ilium to outline the graft. The graft was removed in

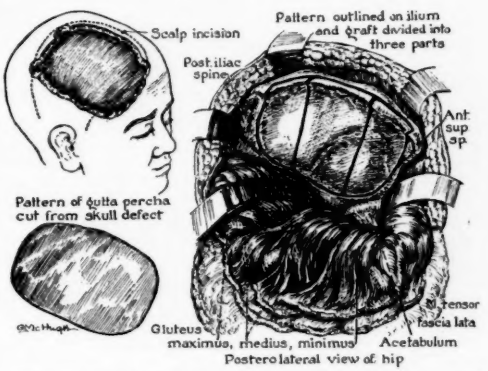
Scalp incision
Pattern outlined on ilium and graft divided into three parts
Post iliac spine
Ant sup sp
Pattern of gutta percha cut from skull defect
Tensor fascia lata
Gluteus maximus, medius, minimus
Acetabulum
Postero lateral view of hip

Fig. 1. Sketches to show the operative procedures used in cranioplasty using grafts from the ilium. In the upper left hand corner the bony defect is shown, with the dural defect closed by fascia lata.

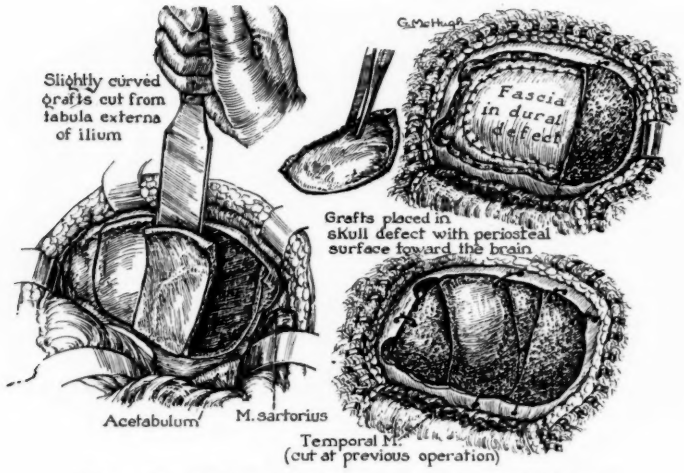
Slightly curved grafts cut from tabula externa of ilium
Fascia in dural defect
Grafts placed in skull defect with periosteal surface toward the brain
Acetabulum
M. sartorius
Temporal M. (cut at previous operation)

Fig. 2. The placing of the bone grafts in the cranial defect.

three portions with a thin wide-bevelled chisel from above downward. The gluteal fascia was then sutured along the iliac crest to the muscular attachments above. One Penrose drain was used. The grafts, with the roughened surface toward the skin, were fitted into place and held with silver wire. Perforations were made in the grafts and in the margins of the skull defect. The skin was closed over the grafts with interrupted silk sutures.

The leg was placed in an aluminum posterior splint with a crossbar rest to prevent external rotation while the muscles were becoming reattached. The postoperative course was uneventful. The patient was able to walk with the aid of crutches in four weeks and without crutches in five months. Some weakness of the abductor and internal rotator muscles gradually disappeared. Fifteen months after operation, examination revealed no abnormal neurological signs, and there was no apparent muscular weakness in the leg. Walking caused no inconvenience, but in running and in carrying heavy loads the man noticed some impairment of function.

The average surface available for a graft from the external surface of the ilium is approximately from 14 to 15 by 9 to 12 cm. An obvious objection to the removal of a large graft from the ilium is that a spontaneous fracture of the ilium may result. There may be a limp lasting several months as a result of weakness of the gluteus muscle. Another disadvantage of the method is that two surgical teams are necessary to perform the two major procedures. The cosmetic result is superior to that obtained with the use of bone from the ribs or tibia. However, it is no better than that which may be obtained with the use of nonosseous substances. The desirability of the procedure will depend upon the ultimate fate of the graft and the relative likelihood of infection if an osseous or a nonosseous graft is used. Osseous transplants are eventually absorbed and leave a dense sheet of fibrous tissue. This may maintain a good cosmetic result but affords little protection

The author and his coworkers are using a plastic (methyl methacrylate), which is readily molded to the desired shape and size, evokes but minimal tissue reaction, and has durability. The method of employment of this type of graft is described.

JOHN L. LINDQUIST, M.D.

O'Connell, J. E. A.: Traumatic Cerebral Fungus. *Brit. J. Surg.*, 1943, 30: 201.

This article is based upon 11 cases of cerebral fungus of traumatic origin found among 38 patients with penetrating cranial wounds who were consecutively admitted to the neurosurgical unit of an E.M.S. hospital.

The fungus may be of a progressive type, found in the more extensive wounds, or of a nonprogressive type, found in the wounds of less extent. The progressive fungus usually develops in from seven to fourteen days. Magnant says that spreading infection results in an earlier onset of progression.

The protruding cerebral tissue is soon covered by flakes of lymph and superficial sloughs. In time, this becomes reddened and somewhat firm and rigid and then resists further deformation. After the cortex reaches the stage resembling granulation tissue, a gradual epithelial ingrowth finally forms a dense cicatricial covering.

The cerebrospinal-fluid pressure was usually within normal limits and rarely went above 200 mm. The rachidian quotient, or relation of the amount of fluid withdrawn to the resultant fall in pressure, had a fairly definite relationship to the stage of the fungus. Before protrusion, a withdrawal of 20 cc.

produced a marked fall; however, during the protrusion stage 100 cc. fluid had to be withdrawn to produce a similar fall. In the final stages of healing the relation again reverted to that of the first phase.

Usually there was a pleocytosis (lymphocytic) and a raised protein content; however, the fluid was occasionally normal.

The etiological theories of Magnant, Lomey and Flourens, Nelation, and Leriche, are each shown to be faulty. The author gives his own hypothesis in the following summary:

". . . it may be stated that when the breach in the cerebral coverings is of sufficient extent, ventricular dilatation (which always occurs into injured brain because of the increments in intraventicular pressure during a cardiac systole and expiration) will be unresisted, and will carry the cerebrum through the dural defect to give rise to a cerebral fungus. If the fungus is controlled the injured cerebrum eventually becomes converted into granulation tissue of sufficient rigidity to resist variations in intracranial pressure, and protrusion no longer occurs. With epithelialization of the area healing is complete."

Treatment depended on whether the fungus was of the large progressive or smaller nonprogressive type. In the nonprotruding type the application of a nonirritating and nonadherent dressing plus a course of sulfonamides was the only treatment. In the more extensive cases the same type of dressing and chemotherapy were used, but stress was placed on the importance of keeping down the intracranial pressure. This was done by (1) posture, (2) repeated lumbar punctures with removal of enough fluid to convert the protrusion into a concavity, and (3) dehydration by limiting fluids, and at times by saline purges and magnesium-sulfate enemas.

Since adhesions prevent the cerebrum from falling in, these were at times very carefully liberated from the skin with soft, moist cotton pledgets.

There were no cases of true meningitis and no deaths in this series of cases.

JACK I. WOOLF, M.D.

EYE

Grossmann, E. E.: The Relationship of the Eye to Antiaircraft Gunnery. *Mil. Surgeon*, 1943, 92: 383.

Grossmann discusses the relationship of the eye to anti-aircraft gunnery. He points out that because a difference in plane between two objects cannot be discriminated if these objects are more than 500 yards away it is necessary to utilize artificial means which introduce greater separation between the viewing points of the two eyes and magnification. For this purpose binocular single vision is essential. An anti-aircraft crew consists of 4 spotters situated about 200 yards in front, behind, and on each side, who are in direct telephonic communication with the adjusters at the control box. The spotters watch the tracer stream in relation to the target. The gunners watch the target through a telescopic eyepiece. Newer guns are provided with automatic optical directors with good ocular efficiency and depth perception. Examination of gun crews should exclude external eye pathology, especially of the eyelids; inequality of vision; inequality of the refractive errors; faulty color vision; muscle imbalance, and internal ocular pathology.

Entropion, ectropion, trichiasis, chalazia, blepharitis, scarring, contractures, styes, abnormal lacrimal puncta, hypertrophy, cicatrices, inflammations, hyperemia, pterygia, cysts, and tumors of the conjunctiva may interfere with fusion.

In a highly ametropic eye (to avoid diplopia) suppression prevents participation in fusion.

Anisometropia results in asthenopia and deficiency of fusion. Color vision is important for following red or blue phosphorescent tracer bullets and for detecting plane insignia in fog, smoke, rain, and sun.

Heterophoria results in ocular fatigue, headache, dizziness, and drowsiness, and in some cases under strain of fatigue, illness, and malnutrition, diplopia or suppression may deprive the individual of depth perception. Tests for depth perception (Howard-Dolman), for hyperphoria, for near and distance, and the angle of convergence should be determined. The angle of convergence is computed from Duane's formula $\frac{Pd \times 50}{PcB} + 3$ degrees in which Pd = the interpupillary distance and PcB = Pd + 25 mm. A minimum angle of convergence of 40 degrees is required. This allows approximately 80 mm. for the convergence near point.

Chorioretinal lesions may interfere with the peripheral field and possibly with the fusion faculty, especially if metamorphopsia is present.

The following standards are desirable for efficient performance of gun crews:

1. Visual acuity of 20/20 or better and not more than one diopter of difference in refraction of the two eyes.
2. The convergence angle should be not less than 40 degrees.
3. There should be no more than 30 mm. separation of the rods on the Howard-Dolman apparatus.
4. The color perception should be normal or only slightly deficient.
5. The eyes should be free from infection or abnormal sensitivity to glare.
6. The muscle balance should be within normal limits.

JOSHUA ZUCKERMAN, M.D.

Knapp, A. A.: Night Blindness, Improvement with Vitamin D; Including the Experimental Production of Retinitis Pigmentosa and Its Treatment in Human Beings with Vitamin D. *U. S. Nav. M. Bull.*, 1943, 41: 373.

Night blindness, variously called nyctalopia and (incorrectly) hemeralopia, is a pathological disturbance of the light sense. It may be brought on by a local ocular lesion or by a systemic disorder. Generally, the systemic type is regarded as a manifestation of vitamin A deficiency. Actually, however,

vitamin D also is vitally concerned in night blindness. Of all ocular conditions giving rise to nyctalopia, retinitis pigmentosa stands in the forefront. Fortunately, it is a rare disease. After much research and experimentation, the author concludes:

Night blindness in man may be caused by vitamin D deficiency. It may be greatly reduced by adequate doses of vitamin D and calcium.

Toxicity of these preparations in sufficient dosage is negligible. The routine procedure was to give each patient a minimum of 60 drops of viosterol (13,860 international units) and tablets containing (in milligrams) calcium 140, phosphorus 83, copper 0.05, magnesium 2.8, and sodium and potassium 5 each. Slight modifications were made according to the individual and his diet.

A comparable condition to human retinitis pigmentosa was produced in dogs.

Night-blind patients were improved considerably by vitamin D and calcium therapy. The apple-jelly pallor of their optic nerves is often changed to normal pink or erythematous color.

Nyctalopia of myopes is often helped by this medication.

Night blindness may be caused by a deficiency of at least 2 vitamins, A and D.

When it is desirable to improve the night vision of the patients, particularly in the armed forces, it would be well to fortify their diet with comparatively large doses of vitamins A and D.

LESLIE L. MCCOY, M.D.

Gallardo, E., and Hardy, L. H.: Virus Isolated from Keratoconjunctivitis. *Am. J. Ophth.*, 1943, 26: 343.

A number of interesting questions arose after a thorough investigation of the case reported in this article, the most important of which concerned the keratoconjunctivitis characteristics, the identity of the isolated virus, and the relationship of the virus to the disease.

Since ocular pemphigus has no pathognomonic clinical or laboratory findings, the diagnosis in early cases must be made cautiously. The typical signs of the disease include progressive cicatrization and shrinkage of the conjunctiva, more marked in the lower fornices; a progressive pannus with irregular vascularization differing from that of trachoma; a low-grade conjunctival eosinophilia; and bullous involvement of other membranes, particularly of the mouth.

The virus isolated in this study certainly was closely related to vaccinia virus, although the clinical disease bore no similarity in appearance or clinical course to vaccinia.

An etiological relationship between the S. virus and the conjunctival disease from which it was isolated might be presumed from the fact of repeated isolation and from the neutralization of the virus by the patient's serum.

A case of severe chronic cicatrizing keratoconjunctivitis with pannus, similar in clinical appearance and course to ocular pemphigus, is described. A presumptive diagnosis of ocular pemphigus was made on the basis of (a) the slow progressive cicatrization most marked in the lower fornices, (b) the periods of remission, and (c) the absence of follicles, inclusion bodies, or typical pannus of trachoma The skin and other mucous membranes were not involved.

A virus, designated as S. virus, similar to if not identical with vaccinia virus, was isolated from conjunctival scrapings during three different periods of exacerbation of the disease. Typical elementary bodies and cytoplasmic inclusions like those of vaccinia were found.

The possibility of a laboratory contamination with rabbit pox vaccinia was considered but could be ruled out.

The virus was isolated both by rabbit-cornea and mouse-brain inoculations as well as by inoculation of the chorioallantois of the developing chick embryo. The close relationship to vaccinia virus was shown by neutralization tests in which vaccinia-immune serum neutralized the S. virus and anti-S. serum neutralized vaccinia virus.

The relationship of the virus to the keratoconjunctivitis must remain an open question until observations on other similar cases become available.

LESLIE L. MCCOY, M.D.

Gifford, S. R., and Konné, M.: Filaria Loa Removed from Upper Lid. *Arch. Ophth.*, Chic., 1943, 29: 578.

One of the co-authors (M.K.) who had been stationed in Equatorial Africa as a parasitologist from 1937 to 1940 in a region heavily infested with filaria loa had shown clinical signs of infection in 1938 with an eosinophilia, but examination of the blood for the organism was negative at that time. In April, 1940, when on leave in Chicago he suffered pain in the left eye and a parasite could be seen moving beneath the lower part of the bulbar conjunctiva. It seemed to be from 2 to 2.5 cm. long and was noted to raise one end repeatedly as though trying to escape. A small ridge of the conjunctiva was raised as a result of its rapid motions. Pain was not severe and there was no subconjunctival hemorrhage, only slight injection. Removal was not attempted at that time and the movements ceased after about eight hours. The following day an examination of the blood revealed no microfilaria.

On subsequent occasions tender swellings were noted in various parts of the body, such as the back, arms, and chest, subsiding in from a few hours to two days. The worm never again appeared under the conjunctiva, but in May movements could be felt under the right upper lid and it was noted to be moving under the skin of the lid near the border. A few minims of 4 per cent procaine hydrochloride were injected beneath the worm with the idea of paralyzing it. A curved needle armed with silk was then passed beneath the worm and out through the skin, the loop of silk being drawn moderately tight about the fold of skin containing the parasite. An

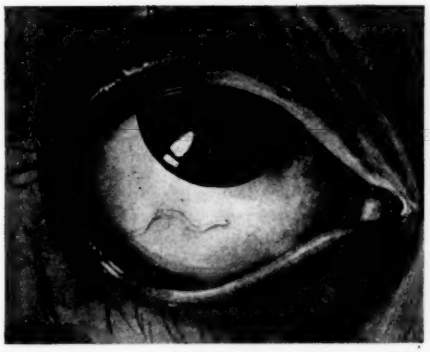

Fig. 1. Appearance of the filaria under the bulbar conjunctiva.

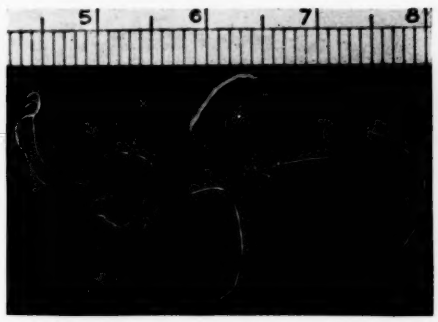

Fig. 2. Fragments of the filaria after removal (about three times the actual size).

incision along the fold of skin revealed the worm which was then grasped with forceps. This caused vigorous movements but the thread prevented its escape and it was removed intact.

The parasite was the size of a piece of surgical catgut and about 3 cm. long, no definite head being visible. It was later identified as an adult female of the filaria loa. On the day after removal there was a pronounced redness and swelling of the lid, probably the result of the release of toxic fluid from the worm. This cleared up in a few days, but swellings have since appeared in other locations, which indicate the presence of another parasite.

Cases of infection with filaria have rarely been reported in the United States. In certain rare cases, such as the present one, only one viable worm or two of the same sex have been inoculated into the patient. In such cases no microfilaria are ever found in the blood stream and the worms eventually die without reproducing. The disease has never been endemic in the United States and in all recent cases the patient has at some time been in Africa.

WILLIAM A. MANN, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Moritz, A. R.: Mechanisms of Head Injury. *Ann. Surg.*, 1943, 117: 562.

This well illustrated article deals with the actual mechanism involved in the production of various kinds of head injuries. Considerable information can be obtained by examining wounds, the skull, and x-ray pictures. From this examination it is possible to draw certain deductions as to how any particular injury was produced, and, incidentally, certain alleged methods of production can be ruled out.

Although the article contains nothing new with regard to actual pathological processes, it emphasizes the practical application of identifying certain types of injuries as having been produced in a certain manner. The various confusing situations which result in head history are mentioned in brief case reports, such as the individual who was arrested for drunkenness and died in the police cell that night with a bruise on his forehead. The police were blamed for having assaulted him, but it was fortunately discovered that he had died from ruptured intracranial aneurysm.

The article should provide interesting reading for those who are brought in contact with the immediate medicolegal results of head injuries.

ADRIEN VERBRUGGHEN, M.D.

Heppenstall, M. E., and Hill, D.: Electroencephalography in Chronic Post-Traumatic Syndromes. *Lancet*, Lond., 1943, 244: 261.

Of a series of 150 persons, largely service men, suffering from postconcussion syndrome (persons whose presenting and predominating symptoms were headaches, irritability, postural giddiness, emotional lability, and impaired memory retention), 78, or 52 per cent, showed abnormalities in the electroencephalogram. Of these 78, 45 per cent had an abnormal response to hyperventilation, although in 5 this was the only abnormality. The EEG abnormalities were divided into diffuse and focal types; 32 were focal and 41 diffuse.

The age at which the head injury occurred was important, and it was found that 65 per cent of those whose injury occurred prior to the age of twenty developed a permanently altered EEG, whereas but 46 per cent of those whose injury occurred after the age of twenty developed such a change.

An association was found in connection with the length of the post-traumatic amnesia. Of those in whom the period was less than one hour, 43 per cent showed changes, of those in whom it was less than one day 52 per cent showed changes, and of those in whom the period was greater than one day, 58 per cent showed changes. The percentage of focal abnormalities was much higher in patients who had prolonged amnesia. A positive family history of mental abnormalities appeared to make little difference as to whether a person would have an abnormal EEG following an injury. The patients with such a history, however, were more apt to have a diffuse type of change when they did have an altered EEG. Diffuse abnormalities were found significantly more often in depressive, anxious, schizophrenic, and hysterical syndromes, in cases of short post-traumatic amnesia, and in patients with a positive personal history.

JOHN W. EPTON, M.D

Ray, B. S., and Parsons, H.: Subdural Abscess Complicating Frontal Sinusitis, *Arch. Otolar.*, Chic., 1943, 37: 536.

Subdural abscess is a serious, though infrequent, complication of frontal sinusitis, which constitutes a distinct pathological and clinical entity but which has not received wide recognition. Three cases of subdural abscess complicating frontal-sinus infection are presented and certain conclusions are reached.

Acute purulent frontal sinusitis, if the sinus is not adequately drained, may result in a subdural abscess through thrombophlebitis of the small veins draining the sinal mucosa.

There may or may not be associated osteomyelitis of the frontal bone or local necrosis (osteitis) of the posterior bony plate of the sinus, but with rare exceptions there is some degree of inflammation of the local dura, usually with an epidural abscess, preceding the subdural abscess.

The extension of infection to the dura can often be recognized in ample time to prevent further intracranial complications.

A sudden onset of jacksonian convulsions and hemiplegia in the presence of acute frontal sinusitis usually indicates the development of a subdural abscess.

The subdural abscess is usually limited in the beginning to the same side as the diseased frontal sinus but it tends to spread over the entire cerebral hemisphere, and, in the later stages, to the opposite side.

Drainage of a subdural abscess should be through one or several trephine openings, preferably placed in the frontotemporal and occipital regions.

JOHN F. DELPH, M.D.

Fleming, G. W. T. H., and McKissock, W.: Prefrontal Leucotomy. *Lancet*, Lond., 1943, 244: 361.

The authors report on a new series of 15 cases of prefrontal leucotomy. They used the usual technique for the operation, but instead of a leucotome an ordinary ventricular trocar and needle was used. The needle was withdrawn to see if any cerebrospinal fluid was coming out, and if there was none, the blunt trocar was used to divide the white matter on both sides.

There were 12 patients with depressions of varying age and duration and different types (9 involutional, 1 with severe hypertension, 1 reactive, and 1 with the paranoid syndrome); of the remaining 3 patients, 1 had obsessions, 1 was a schizophrenic, and the last was a manic-depressive. Of the first 12, 7 made complete recoveries, 1 showed considerable improvement, and 4 showed little improvement. The obsessional and manic-depressive cases were improved while the schizophrenic was not improved.

Two patients with involutional depression who were not doing well suddenly began to improve after being spoken to sharply. Both did well at home. After the operation 5 cases were wet. The schizophrenic had a single seizure since the operation, and 1 other patient had a series of 13 seizures, but this patient was hypertensive and it is possible that her fits were of hypertensive origin. One patient with melancholia, seventy years of age, developed parkinsonian tremors of her arms and lips. None of the patients died. DAVID J. IMPASTATO, M.D.

Hutton, E. L.: Results of Prefrontal Leucotomy. *Lancet*, Lond., 1943, 244: 362.

The author presents the results in 50 cases of prefrontal leucotomy. Two patients died, one from cerebral hemorrhage caused by accidental section of the anterior cerebral artery, and the other from cardiac failure. In most of the cases the postoperative course was uneventful. Enuresis, usually transitory, occurred in several cases. Other neurological complications were rare. One patient had an epileptiform attack five months after operation.

Leucotomy has been advocated in cases in which the prognosis was poor, and in which other methods had been tried and had failed to produce permanent improvement, or in cases in which no benefit was to be expected from current methods of treatment. In view of the chronicity of many of the cases the results are encouraging. Not a single patient was worse after the treatment than before, and even in the least satisfactory cases the patient is usually found to be quieter, less impulsive, more amenable, more manageable, and less disturbing.

The treatment has been tried in varying forms of mental disorder—namely, schizophrenic, depressive, and psychoneurotic states—and improvement has been obtained in every type. Results seem to be most successful when there is a very strong negatively toned emotional factor, such as apprehension, anxiety, inadequacy, and guilt. The least successful results have been obtained in simple schizophrenia with emotional apathy and mental reduction.

Although the individual's response to the operation is dependent on his prepsychotic personality, there are certain characteristic tendencies which all patients show. Complacency is one of the most outstanding features; they are self-satisfied and easily pleased with their environment and, although they may be irritated with things which conflict with their wishes or interfere with their comfort, they are not readily disturbed nor easily upset.

TABLE I.—RESULTS IN 50 CASES OF PREFRONTAL LEUCOTOMY

	Recoveries	Improvements	No improvements	Deaths	Total
Schizophrenia	2	18	11	1	32
Psychoneuroses	3	2		1	6
Depressions (mixed)	5	4	2		11
Mental deficiency		1			1
Total	10	25	13	2	50

Those patients who were intelligent, active, and industrious before their breakdown, may appear even more intelligent, active, and industrious after operation, because they are no longer inhibited by their thoughts. On the other hand, the patient of limited intelligence, if left to his own devices, will show definite apathy, idleness, and lack of initiative. If, however, he is not left to himself, but is made to attend to events happening around him and to take his share in such events, the degree of re-education and resocialization which can be achieved is both surprising and gratifying.

Routine testing indicates that no gross alteration of the intelligence occurs as a result of the operation. Most of the patients gain weight. Menstruation returned in some of the patients who suffered from amenorrhea prior to the operation. In 2 cases menstruation ceased after operation. Libido returned in some of the male patients.

DAVID J. IMPASTATO, M.D.

McCall, J. W., and Gardiner, F. S.: Facial Paralysis Following Mastoid Surgery. A Report of 3 Cases Treated Successfully. *Laryngoscope*, 1943, 53: 232.

The treatment of facial paralysis following mastoid surgery is discussed and 3 successfully treated cases are presented. The criteria for treatment of these cases depend upon the time of onset of paralysis and its duration, and on the response to electrical stimulation. An onset of facial paralysis more than twelve hours after operation is not likely to be due to anatomic interruption of nerve continuity. The onset of paralysis immediately, or within a few hours, accompanied by a negative response to faradic stimulation indicates either division or compression of the nerve, while a positive response indicates an intact nerve with a physiological block from edema, packing, or clot. When the faradic response is absent the mastoid wound should be reopened immediately and any compressing elements removed. If the nerve has been divided and nerve substance lost, a free nerve graft should be done. Observation with supportive treatment is the advisable procedure when the faradic response is retained, since complete recovery usually takes place in the cases. Galvanic stimulation, heat, and massage are used to maintain muscle tone. In cases of long-standing facial paralysis the criterion for operation is the response of the muscles to galvanic

stimulation. A negative response means that muscle degeneration and fibrosis have occurred and operation will be futile. Operation is done according to the technique of Ballance and Duel when the galvanic response is positive.

Among the 3 cases reported, 1 patient developed facial paralysis on the eighth postoperative day but retained a response to faradic stimulation. This patient was treated conservatively and made a complete recovery. In the second patient facial paralysis was discovered immediately. Operation was done four days later and depressed bone chips were removed from contact with the nerve. The diagnosis in this case was compression of the facial nerve resulting in degeneration. Except for the frontalis muscle, recovery of function was obtained. The third patient was seen eighteen months after the onset of paralysis. There was no response to faradic stimulation but the muscles reacted to galvanic stimulation. Free nerve grafting was done with the lateral cutaneous femoral nerve. Nine months later there was evidence of recovery of function. When nerve degeneration has occurred the frontalis muscle remains paralyzed following regeneration.

JOHN L. LINDQUIST, M.D.

SPINAL CORD AND ITS COVERINGS

Baertschi-Rochaix, W.: Diagnosis of Protrusion of a Lumbar Intervertebral Disc and Related Conditions (Die Diagnose lumbaler Bandscheibenprolapse und verwandter Zustaende). *Schweiz. med. Wschr.*, 1942, 72: 729.

A suspicion of protrusion of an intervertebral disc is often not confirmed by a careful clinical investigation, but on the other hand the classical syndrome may not be recognized as such, especially in early stages of the condition. Furthermore, the neurologist may be surprised by failure of the roentgenologic studies to be confirmed by operative findings. Therefore, it is important to publish atypical cases. It must be remembered that no single symptom is characteristic for the condition under discussion and that a correct diagnosis can be made only on the basis of combined neurological, orthopedic, and roentgenological findings, as well as the history.

As to the history, a protrusion of an intervertebral disc should be suspected if complaints of lumbago or sciatica exist more than six months, do not respond to the customary therapy, and appear in a recurrent form. As far as neurological symptoms are concerned, Lasègue's symptom is not specific and hardly of any value for the differential diagnosis. Increased albumin contents of the spinal fluid are suggestive of protrusion of a disc. The Queckenstedt test can be performed without spinal puncture; a resulting stabbing pain in the spine or lower extremities justifies a suspicion of a compression within the spinal canal. The author noticed that this test is more frequently positive when the patient is in an erect position than when he is in a recumbent one. Radicular pains in the lower extremities, provoked by certain body movements, support the suspicion of a protruded disc. As to functional tests, pains radiating into the lower extremities and caused by lordotic movements are strongly suggestive of a protruded disc. Other functional tests are not characteristic but an absence of any functional disturbances in the lumbar region speaks against a protrusion. An injection of a contrast medium into the spinal canal is indicated only if the history is characteristic, the findings suspicious, and the complaints obstinate and of more than from six to twelve months' duration.

The author reports 6 typical cases which demonstrate the variability of symptoms, their changing intensity and location, and 6 more cases which were atypical in one respect or another. In 2 cases extradural varicosities were found at the level of the intervertebral discs. Either a traumatic protrusion of a disc which regressed later on and caused a mechanical injury of the wall of a vein, or a reversible, so-called mobile type of injury of a disc gradually produced a venous congestion. Possibly both mechanisms played a role. The varicose veins were removed by electrocoagulation.

In 2 other cases the operative findings were entirely negative and yet the laminectomy was followed by a complete disappearance of the symptoms. The customary position of the patient during the operation offers the least chance to discover a reversible protrusion. After an arch has been removed, caudal fibers have an opportunity to escape compression and thus the beneficial effect of an operation may be explained. These 2 observations suggest the existence of mobile or functional, reversible protrusions.

Finally, in the remaining 2 cases a hypertrophic ligamentum flavum was found instead of a protruded disc. Probably one of the discs must have been injured following the trauma, with a resulting hypertrophy of the ligament, due to a change in the static condition.

The author concludes that the relations between extradural varicosities and a protruded intervertebral disc are of a hypothetical character; on the other hand, he does not doubt that so-called functional or mobile protrusion and also the hypertrophy of the ligamentum flavum represent special types of the customary picture of a protruded disk.

JOSEPH K. NARAT, M.D.

Cohen, I., and Kaplan, A.: Tumors in the Region of the Cauda Equina. A Review of 25 Cases. *Am. J. Surg.*, 1943, 60: 36.

To a great many surgeons the differential diagnosis of low back pain with or without sciatic radiation is a daily and a very important problem. This problem calls for a systematic investigation of the many causes of the so-called "sciatic syndrome." Among these causes, particularly since the publications of Mixter and Barr, the herniation of an intervertebral disc and hypertrophied ligamentum flavum have gained such prominence that other causes of sciatic pain are being pushed to the background and are failing to receive the attention they

deserve. Among these less frequent, but equally important, causes responsible for back pain with sciatic radiation are tumors of the cauda equina.

Experience has shown that the presenting symptoms in early cases of tumors of the cauda equina are not unlike those in patients with a herniated nucleus pulposus. Because of this great similarity, a review of these tumors was undertaken to learn if there are any dependable criteria of differentiation. From a therapeutic point of view it is very important to distinguish between these two conditions, especially since the operative exposure of a disc is, as a rule, a very limited one, and a neoplasm of the cauda equina can readily be overlooked through such an exposure.

The group of 25 patients with tumors of the cauda equina represents 18.5 per cent of the total number of spinal-cord tumors in the authors' series. While analyzing this series of cases it became quite evident that in the very early stages neoplasms in this region are unusually difficult to recognize, and at times practically impossible to differentiate from a herniated intervertebral disc. On the other hand, in the very advanced stages the diagnosis of a cauda-equina tumor can often be made at a glance.

The most frequent type of tumor was the neurofibroma, of which there were 10; there were 4 ependymomas, 2 meningiomas, 2 neubroblastomas, and 4 miscellaneous growths.

The spinal-fluid studies were of greatest help. In 1 patient in whom fluid could not be obtained, a tumor which completely filled the lumbar canal was found at operation. In 17 of the remaining 24 patients the spinal fluid was xanthochromic. The finding of xanthochromia in a protruded disc is so rare that the question of a neoplasm should be raised immediately. The authors have found multiple spinal punctures to be of considerable localizing value, so much so that some patients have been spared lipiodol injection.

While there was no operative mortality or death in the hospital, the patients with malignant tumors survived but a few months. The majority of patients, even those with advanced lesions at the time of admission, have done exceedingly well.

The authors conclude that the early diagnosis of neoplasms in the region of the cauda equina can and should be made before the roots have suffered serious damage. A patient with a history of intermittent "sciatic" pain which fails to respond to simple nonsurgical measures, should have the benefit of complete spinal-fluid studies. If there is any doubt as to the exact location of the tumor, lipiodol injection is indicated. JOSEPH K. NARAT, M.D.

Kennedy, F., Denker, P. G., and Osborne, R.: Early Laminectomy for Spinal Cord Injury Not Due to Subluxation. *Am. J. Surg.*, 1943, 60: 13.

The authors give a historical review of the problem of intervention versus nonintervention in spinal-cord injury. They believe that the concepts of the noninterventionists are either outmoded or based on shaky precepts which do not hold, such as the danger of spinal shock, physiological interruption equals anatomic interruption, and perhaps also that the x-rays are specific.

They point out that the presence of spinal shock cannot be determined with any degree of assurance. In addition, they hold that physiological cord block cannot be distinguished from cord block caused by transverse destruction. Their case histories clearly show that bony lesions can be missed by the x-rays.

A modern laminectomy carries little risk, and, inasmuch as the injured patient has nothing to lose and all to gain by the operation, it is strongly advised. If operation is decided upon it should be performed as soon as the patient's general condition allows. These cases are surgical emergencies.

DAVID J. IMPASTATO, M.D.

PERIPHERAL NERVES

Highet, W. B., and Holmes, W.: Traction Injuries to the Lateral Popliteal Nerve and Traction Injuries to Peripheral Nerves after Suture. *Brit. J. Surg.*, 1943, 30: 212.

This report is of a series of 8 cases of traction injury to the lateral popliteal nerve which have been treated surgically and the lesions examined histologically.

The damage in traction injuries is much more extensive than that following incision, laceration, or gunshot wounds, and the changes of fiber degeneration, fibrosis, and vascular abnormality extend far above the damaged site.

None of the cases showed a spontaneous recovery, even in those cases in which the "nervous tissue was continuous throughout the lesion." Although regenerating nerve fibers succeeded in crossing the lesion, they remained small and nonmyelinated.

End-to-end anastomosis was performed in 3 cases after extensive resection and good approximation by mobilization of the nerve and flexion of the knee, but no recovery took place. These cases were reexplored and showed a similar but more severe pathological process than in the original lesion. In a case in which a less extensive resection was necessary, a good recovery is in progress.

The authors conclude that the operative-repair failures were due to injury inflicted on the nerve during the postoperative extension of the joint.

JACK I. WOOLF, M.D.

SYMPATHETIC NERVES

Bordley, J., Galdston, M., and Dandy, W. E.: The Treatment of Essential Hypertension by Sympathectomy. A Report on 12 Patients Three to Seven Years Following operation. *Bull. Johns Hopkins Hosp.*, 1943, 72: 127.

The results of splanchnicectomy in 12 patients with essential hypertension are reported. Ten of the patients were followed up for from three to seven years, 2 having died shortly after operation. The

sole criterion for operation was the presence of incapacitating symptoms. The Peet supradiaphragmatic operation was performed in 3 patients and the Adson-Craig infradiaphragmatic operation in 9. The Peet operation was supplanted by the Adson-Craig procedure because the latter permits exploration of the kidneys and adrenal glands and interruption of a large part of the sympathetic supply to the legs. Ten patients were between twenty-eight and forty years of age and 2 were fifty years old at the time of operation. Preoperative and postoperative studies of the arterial pressure, heart size, eye grounds, urea clearance, phenolsulfonphthalein excretion and urine-concentrating power, cold press or response, and response to passive changes in posture were carried out. The completeness of sympathectomy was ascertained by starch-iodine sweating tests, and skin resistance and temperature studies.

Relief from symptoms referable to hypertension occurred in 9 of the 12 patients shortly after operation. In 5 of these patients it was associated with a lowering of the arterial pressure, while in the remaining 4, it occurred in the absence of change in the hemodynamics. In 4 cases symptoms returned when the arterial pressure rose to preoperative levels which would make it appear that the relief depended upon lowered arterial pressure. However, in one patient whose arterial pressure returned to the preoperative level in less than two years, with evidence of progression of cardiovascular renal disease, there have been no complaints over a period of four years. The arterial pressure was reduced for from six to eighteen months in 4 of the 9 patients treated by the Adson-Craig operation and for four and one-half years in 1 of the 3 treated by the Peet operation.

Return of the arterial pressure to preoperative levels was not accompanied by regeneration of the sympathetic innervation of the lower extremities as indicated by sweating, skin resistance, and temperature studies. In a few patients there was objective evidence of regression of the cardiovascular abnormalities during the period of lowered arterial pressure. These reappeared after the arterial pressure had risen to its previous levels.

Postural hypotension lasting from six to nine months was noted in 4 patients following the Adson-Craig operation and in none following the Peet operation. A striking postural dyspnea accompanied it in 3 instances and subsided a few months before the postural hypotension. Operation did not alter the response to a cold stimulus even when the arterial pressure was at a lowered level. No alteration in sexual function following infradiaphragmatic splanchnic resection was found. Four case reports with graphic charts are presented.

JOHN L. LINDQUIST, M.D.

SURGERY OF THE THORAX

TRACHEA, LUNGS, AND PLEURA

Mazet, R., Jr.: Migration of a Kirschner Wire from the Shoulder Region into the Lung. Report of 2 Cases. *J. Bone Surg.*, 1943, 25: 477.

Two cases are reported in which Kirschner wires migrated from the shoulder region into the lung.

In Case No. 1 there was a definite separation of the right acromioclavicular joint. A blind wiring was first done, which was unsuccessful. Later two Kirschner wires were inserted. In six weeks one of the wires had worked out of the clavicle but remained in the acromium. At ten weeks one of the wires palpable beneath the deltoid was removed. The second wire appeared to be lodged in the right lung. At twelve weeks a gradual partial collapse of the right lung was carried out.

At fourteen weeks the wire was removed through an anterior incision. The wire was 52 mm. in length. The patient made a rapid and uncomplicated recovery. Four months following removal of the wire there were no signs of pathology to be found in the chest.

Case No. 2 was that of a sixteen-year-old white female with old poliomyelitis of the right shoulder. This was fused with 3 Kirschner wires by passing them through the humeral head and into the glenoid. At eighteen weeks the x-rays showed good fusion of the shoulder and 2 wires were removed by an assistant. Later x-rays showed a portion of wire in the right chest. At twenty-two weeks an operation was performed and the wire was removed. Nine months following the operation the girl was in excellent health and the shoulder was solidly fused.

It appears that if wires are employed for fixation some sort of nut or stop which will prevent migration is necessary. RICHARD J. BENNETT, JR., M.D.

Miscall, L., and Rovenstine, E. A.: The Physiological Basis for the Surgical Treatment of Asthma. *Surgery*, 1943, 13: 495.

Asthma may be defined as an abnormal type of respiration due to obstruction of the conducting airway system. In some types of asthma the breathing is a response to exaggerated reflex activity carried in pathways over which normal respiratory reflexes usually flow. In asthma an intrinsic pulmonary factor produces widespread obstruction of the conducting airway system. These reflexes originate in the lung and the afferent pathway is over the sympathetic nervous system and thus may be interrupted surgically as a therapeutic measure.

The authors review the pertinent anatomic and physiological evidence for the construction of these reflex pathway patterns. The excursion in the respiratory conducting airway system essential to normal breathing may involve marked relaxation and constriction of the bronchial muscles or may not be reflex in type. The reflex of constriction is afferent with the sympathetic nerves and efferent in the vagus nerve. Whereas the reflex of dilatation is *vice versa*. The afferent impulses of constriction may be interrupted at the stellate and second, third, and fourth thoracic ganglia. Bronchial asthma precipitated by recurrent infection of the bronchi is caused by excitation of the reflex of constriction and may be benefited by interrupting this pathway.

Temporary interruption of the pathway will determine whether the asthma is on the basis of infection or allergy. When due to the former, permanent interruption may be effected by surgical intervention.

The author's experience includes 95 neurolytic injections in 72 patients. The present practice is to block the afferent sympathetic pathway at the stellate and second and third thoracic ganglia on the right side. In 47 (78 per cent) of 61 patients whose afferent pulmonary sympathetics were successfully blocked, immediate improvement was noted. The results were observed up to a maximum of thirteen months.

Following the establishment of the basis for the asthma, operation was carried out in 21 patients. These were observed from three months to two years, all having complete relief from asthma. These results demonstrate the importance of surgical therapy in protracted asthma due to infection in the bronchi. WILLIAM E. ADAMS, M.D.

Russo, J. G.: Extrapleural Pneumothorax. *J. Thorac. Surg.*, 1943, 12: 316.

Extrapleural pneumothorax was first performed by Tuffier in 1910 but the value of this procedure was not recognized until 1936. The author reports his experience with 38 patients, between August, 1938, and 1942, on whom extrapleural pneumothorax was performed in the treatment of pulmonary tuberculosis. The patients' ages varied from twenty-one to sixty-seven years.

Indications for operation varied somewhat; however, in general the operation was performed when thoracoplasty was contraindicated or refused by the patient. In some earlier cases this procedure was done as a last resort when there was a hopeless outlook.

The results in the 38 cases were as follows: 13 patients were discharged, 21 are still in the sanatorium, and 4 died. Of the group, 8 had a bilateral operation and 4 had a thorocoplasty on the contralateral side at the time of operation. In 22, or 58 per cent, there was sputum conversion. Approximately one-third of the patients developed an extrapleural empyema. All of the 4 deaths in this series of cases occurred several months after operation and were therefore chiefly due to the disease itself rather than the operative procedure.

From his experience with these cases the author concludes that extrapleural pneumothorax is an important operation for certain cases. The patients should be carefully selected, for in only a relatively small per cent is this operation indicated. The operation *per se* is less shocking than thoracoplasty and can be made in patients for whom thoracoplasty is contraindicated. Its usefulness is considerably reduced by the frequency of complications. However, for the most part these complications are not extremely serious. WILLIAM E. ADAMS, M.D.

Gowar, F. J. S.: Carcinoma of the Lung: The Value of Sputum Examination in Diagnosis. *Brit. J. Surg.*, 1943, 30: 193.

The surgical treatment of carcinoma of the lung has made rapid strides in the last few years, and there is today a reasonable hope of achieving a radical cure of the disease if the diagnosis is made sufficiently early. At the present time the diagnosis is made in the majority of cases when the growth is well advanced, and only about 10 per cent of the cases are potentially operable when first diagnosed; of these not more than 60 per cent are likely to be found operable when exploratory thoracotomy is undertaken. The earlier the diagnosis can be made, the more cases will be found operable. Any method, therefore, which may lead to an earlier diagnosis, or which may enable a suspicion of neoplasm to be confirmed will enable the surgeon to find more cases suitable for operation.

The presence of carcinoma cells in the sputum has always been regarded as a rarity. Dudgeon and Wrigley (1935) published a detailed account of a method for the examination of the sputum for evidence of malignant growth. These authors used the wet-film method, which was introduced for the study of new growths and of normal and pathological tissues by Dudgeon and Patrick.

The sputum from 93 cases of suspected neoplasm of the lung has been examined by the author by Dudgeon's wet-smear method. In a large proportion of cases (64.3 per cent of proved or probable carcinomas) it has been possible to demonstrate malignant cells in the sputum. It was not only in the advanced cases that such cells were found; in a significant proportion of the cases the growth was operable.

The test is of value in establishing the diagnosis of malignancy in cases in which other methods of investigation, including bronchoscopy, have failed, and in which it is desired to explore the chest; in patients too ill to be submitted to other methods of investigation; and in cases in which the growth is masked by inflammatory changes in the lung.

It is urged by the author that the test be employed more widely; this may lead to an earlier diagnosis in some cases. It is further suggested that aspiration-biopsy as a method of diagnosis should be reserved for cases giving repeatedly negative sputum tests, and should not be employed when surgical removal of the growth is envisaged.

JOSEPH K. NARAT, M.D.

King, D. S., and Castleman, B.: Bronchial Involvement in Metastatic Pulmonary Malignancy. *J. Thorac. Surg.*, 1943, 12: 305.

It is commonly believed that metastatic tumor of the lung seldom produces hemoptyses, and if a tumor gives rise to hemoptysis it is primary in the lung.

Two patients illustrate the fallacy of this view. The first, a man of sixty-three, complained of having pain in the upper arm for a period of three months, hemoptysis for two months, and severe pain in the left chest near the sternum for one month. A diagnosis of bronchogenic carcinoma was made and a smear from aspiration biopsy showed tumor cells.

A left upper lobectomy was performed since it was believed that the tumor was primary in the lung. The patient died of pneumonia on the second postoperative day, and at autopsy showed a carcinoma of the stomach. Microscopic sections from the resected lung revealed a similar type of tumor to that of the stomach.

The second patient, a man forty-two years of age, had had a fibrosarcoma of the scrotum removed in 1938. One year later he developed a cough, chest pain, and hemoptysis. The roentgenogram showed complete collapse of the left lung, and a large piece of metastatic tumor was removed through a bronchoscope, with temporary relief of the symptoms. The patient died of respiratory failure, and at autopsy was found to have complete occlusion of the bronchus of the left upper lobe.

A bronchus may be affected by metastatic tumor in two ways, namely, by direct extension or by metastasis to its wall. Either of these may lead to ulceration of the mucosa and the production of hemoptysis.

Farrell, in reviewing 78 autopsy cases of pulmonary metastases, found 2 in which hemoptysis had resulted from ulceration of the bronchial mucosa.

The authors investigated 109 autopsies performed on patients with metastatic tumor of the lung at the Massachusetts General Hospital, Boston, between 1931 and 1940. In 18.3 per cent there had been definite infiltration of the bronchial wall, and 4 of these, or 20 per cent of those with involvement of the bronchial wall, had had a history of hemoptysis. Of the 109 cases, 98 were carcinoma and 11 were sarcoma. Of the 20 cases with involvement of the bronchial wall, 6 were sarcoma and 14 were carcinoma. Nine of these gave no history of pulmonary symptoms. WILLIAM E. ADAMS, M.D.

HEART AND PERICARDIUM

Zerbini, E. J., and Graner, O.: Surgical Treatment of Penetrating Wounds of the Heart (Tratamento cirúrgico dos ferimentos penetrantes do coração). *Rev. cir. S. Paulo*, 1942, 8: 609.

Suture of wounds of the heart was first practiced experimentally in 1882 and practically on human beings in 1896. Any penetrating injury of the chest may involve the heart, the right ventricle being injured most frequently because of its exposed position.

Elkins operated on 38 patients with good results in 22 cases; he found that the best prognosis was in injuries of the right ventricle, which is most frequently injured.

If the heart is penetrated the patient may die quickly of hemorrhage or if the opening in the pericardium is small, blood may collect in the pericardium and cause a tamponade of the heart, which, if acute, results in lowering of arterial pressure, rise of the venous pressure, and decreased amplitude of the movements of the heart. If it is chronic it causes great rise of the venous pressure, slight lowering of arterial pressure, ascites and decreased amplitude of the heart movements. It requires great skill on the part of the surgeon to know just when to operate in such cases.

The authors describe a case in a boy six years of age whose chest wall was penetrated by a flying fragment of iron. He was brought to the hospital in a condition of coma with the radial pulse very small and rapid and for a time imperceptible. There was engorgement of all the subcutaneous veins, particularly of the external jugulars and those of the upper extremities. There was marked cyanosis of the thorax and face. There was a penetrating wound in the precordial region over the left fourth intercostal space. A roentgenogram showed a foreign body in the right heart. Operation was urgently necessary and the venous pressure was not taken.

Operation was performed February 26, 1942. The pericardium contained 150 cc. of clotted blood; the heart was greatly reduced in size, and the amplitude of its beats was small. As soon as the clotted blood was removed the heart regained its normal size and the arterial pressure rose to 100 mm. of mercury. The foreign body had passed through the right ventricle and lodged in the intraventricular septum. It was found impossible to remove it and it was left in position. It had injured an interventricular branch of the left coronary artery, which was ligated. The patient was followed up for ten months after the operation and no signs of infarct of the myocardium appeared. The only changes in the electrocardiogram were those caused by an aseptic pericarditis, which recovered on puncture of the pericardium and medical treatment.

This case shows that the coronary arteries are not really terminal arteries and that a collateral circulation can be established between them. This had been shown previously in animal experiments. There need be no fear, therefore, of causing infarct of the myocardium by ligating them.

AUDREY G. MORGAN, M.D.

MISCELLANEOUS

Buxton, R. W., and White, M. L., Jr.: The Relationship of Suture Material to Healing in Thoracoplasty Wounds. *Am. J. Surg.*, 1943, 60: 252.

This study consists of a clinical investigation of the influence of absorbable and nonabsorbable sutures on wound healing following thoracoplasty. The cases were divided into the following three arbitrary groups:

1. Cases showing demonstrable fluid beneath the skin and muscles, with or without spontaneous escape of fluid but without infection, also those cases with red or "beefy" wounds which did not suppurate.

2. Subcutaneous wounds infected with pyogenic organisms.

3. Submuscular pyogenic wound infections and all tuberculous infections.

Of the 809 wounds studied, 121, or 14.9 per cent, showed one of the mentioned complications. Of the 809 wounds 538 were sutured with catgut and of these 102, or 18.9 per cent, developed wound difficulties. Of 271 wounds closed with silk, 19, or 7 per cent, developed some complication.

The great majority of the complications of both the catgut and silk sutured wounds were in Group 1, 67, or 12.4 per cent, of the catgut sutures and 14, or 5.9 per cent, of the silk sutures being in this group. These complications were never serious and seldom delayed the subsequent operative stages.

The effect of apicolysis appeared to be little on the development of wound complications. Likewise formalin, which was used to prevent rapid stiffening of the thoracic wall by regeneration of the ribs between operative stages, appeared to have little effect on the production of wound complications.

In reviewing the statistics of these 809 operations the authors concluded that the complications following catgut suture were almost three times as numerous as those following the use of silk for suture.

WILLIAM E. ADAMS, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Morse, L. J., and Barb, J. S.: Free Autoplastic Transplants of Fascia Lata in the Repair of Large Incisional Hernia. *Surgery*, 1943, 13: 524.

The most important indication for using the fascial insert is a scarcity of satisfactory tissue about the hernial gap. Tissues that do not lend themselves to adequate repair cannot be expected to withstand the great strain that would be put upon them, particularly with approximation under tension. Such a situation is often characteristic of recurrent hernia, large direct inguinal hernia, and massive abdominal hernia. Obviously, fascial transplantation is not indicated in every case of ventral hernia.

Simplicity keynotes the authors' technique. The peritoneal cavity need not be opened and layer dissection of the abdominal wall is unnecessary, and thus a great saving of time is effected. The defect is exposed and the surrounding fascia is cleansed of all adherent areolar and scar tissue. A releasing incision is made on one side of the defect approximately ½ in. from the margin. The peritoneal bulge is depressed in the defect and the clearly defined margins are readily sutured with interrupted black silk without any tension. The line of the releasing incision in the fascia now gapes and exposes beneath it either the attenuated muscle layer, or, frequently when this is absent, merely the posterior rectus sheath or transversalis fascia. An appropriately sized sheet of fascia lata is excised from the iliotibial tract of the thigh and, after being properly freed of its investing areolar tissue, it is sutured over the newly made defect with interrupted black silk sutures. A large enough graft may be taken to cover the primary suture line as well, and thus a wide margin of overlap with actual contact between the cleansed transplant and the freshened fascial surface is obtained.

STEPHEN A. ZIEMAN, M.D

Crutcher, R. R., Daniel, R. A., Jr., and Billings, F. T.: The Effect of Sulfanilamide, Sulfathiazole, and Sulfadiazine upon the Peritoneum. *Ann. Surg.*, 1943, 117: 677.

The authors have studied the effects of various sulfonamides placed in the peritoneal cavity of dogs. In each experiment the dog was operated upon under aseptic technique and the drug was introduced by one of three methods. In one group the finely powdered crystals were implanted; in a second group the drug was suspended in 50 cc. of sterile water; and in a third group the drug was moistened with water, allowed to dry and form a lump, and the lump was then broken up and introduced. The dosage used was 0.3 gm. per kgm. of body weight. The animals were reopened at various intervals to observe the results. Blood levels were observed at intervals after the initial implantation.

The reactions were graded from slight to moderate and marked.

With 1 exception, no adhesions were noted after the use of sulfanilamide in suspension, whereas adhesions were present in a number of cases in which sulfathiazole suspension was used. When lumps of the drugs were used foreign-body reaction was noted. Sulfadiazine produced numerous adhesions, but this was least marked when the suspension was used.

The blood levels indicated rapid absorption of the sulfanilamide. Sulfadiazine levels were considerably higher than those of the other drugs. It is suggested that the absence of severe reaction from sulfanilamide is due to the rapid absorption and excretion of the drug.

The authors conclude that all 3 of these drugs may cause peritoneal adhesions. Masses of the drugs are apt to wall off as foreign bodies, and every effort should be made to distribute the powder evenly by suspending it in water or saline solution.

JOHN A. GIUS, M.D.

GASTROINTESTINAL TRACT

Slive, A., Shoch, D., and Fogelson, S.: An Experimental Study of Methods for Closing the Duodenal Stump after Gastric Resection. *Surgery*, 1943, 13: 741.

This study was done to evaluate the methods most frequently used for closing the duodenal stump after gastric resection. Closure of the duodenal stump is important because from 10 to 26 per cent of the deaths following gastric resection occur because of leakage from the closed duodenum.

Gastric resections were done on a total of 96 dogs which were divided into groups of 24, each varying with the type of closure. These were:

Series 1. Von Haberer open method without clamps and without crushing of the tissues.

Series 2. The classic Kerr-Parker crushing clamp method.

Series 3. Simple ligature of the duodenum followed by inversion with purse string suture.

Series 4. Same procedure as in Series 3 except that Size A, black silk twist was used instead of the chromic twenty-day 000 catgut used in all the other series.

Inasmuch as emphasis has been placed on back pressure within the duodenum as the cause of separation and leakage, the strength of the above duodenal closures was determined by inserting a glass cannula into the distal end of the duodenum. The cannula was connected to a bicycle pump through a large mercury manometer. The duodenum was inflated and the pressure noted on the manometer at the exact moment of rupture.

Each of the 4 series were further divided into 4 groups of 6 animals. In the first group of each series

the duodenal stump was "blown out" immediately following the operation, and in the remaining groups on the fifth, eighth, and fifteenth postoperative day, respectively.

The manometer readings were graphed and subjected to statistical analyses so that the variations within each group would be accorded proper evaluation.

The strength of all catgut closures was lowest on the fifth postoperative day, after which it increased steadily so that on the fifteenth postoperative day it was almost the same as immediately after operation. The silk closure, which was weaker than the catgut closures immediately after operation, had no postoperative drop. It demonstrated a progressive increase in tensile strength of the stump throughout the entire fifteen-day postoperative period.

This study permitted the following conclusions concerning the results in normal dogs which were free from duodenal pathology:

1. The ligature and purse-string method gave the strongest duodenal closure.

2. The open method of von Haberer gave a stronger stump than the clamp-crushing method of Kerr and Parker.

Because the ligature and purse-string method of closure would require a large area of duodenum, the presence of an ulcer might render this method impractical. In this case, the open method as described by von Haberer would be the procedure of choice. The increased trend of preference toward the use of silk for closing the duodenal stump is substantiated by the results.

Brooks, B., and Weinstein, A.: Cyst of the Ampulla of Vater. *Ann. Surg.*, 1943, 117: 728.

The authors report a rare case of obstruction of the small bowel due to a large polypoid mass in the duodenum. The clinical history showed recurrent attacks of illness characterized by severe epigastric pain, nausea, vomiting, and possibly jaundice. The symptoms persisted for about twenty-four hours, after which the patient considered himself well for a period of one month when a similar attack of illness would appear. Examination showed no abnormalities of the abdomen; the blood and urine were normal except for elevation of the icteric index to 12 units, following one episode of pain. Roentgenological studies gave no definite clue to the condition. There was dilatation of the duodenum and the proximal portion of the jejunum, but the unusual filling defect in the duodenum was not disclosed until operation.

The abdomen was opened to the right of the midline above the level of the umbilicus. Adhesions completely obscured the gall bladder. Approximately the first 2 ft. of the jejunum showed marked hypertrophy and dilatation which terminated abruptly into normal small bowel without any evidence of obstruction. The stomach and first portion of the duodenum appeared normal except for small stellate scarring of the anterior wall of the duodenum just distal to the pylorus. There was no induration or other evidence of duodenal ulcer in the scar. About 1 in. beyond the pylorus the diameter of the duodenum was approximately the same as that of the stomach. On palpation the duodenum appeared tense and fluctuant. When pressure was applied it was at first impossible to cause it to collapse. Subsequently, however, it was noted by the operator that the duodenum had partially emptied in an abrupt manner in the direction of the jejunum, which immediately became distended with fluid. It was impossible to empty the duodenum further. Making an incision in the posterior peritoneum along the lateral wall of the duodenum, the latter, now mobilized, could be delivered into the operative wound.

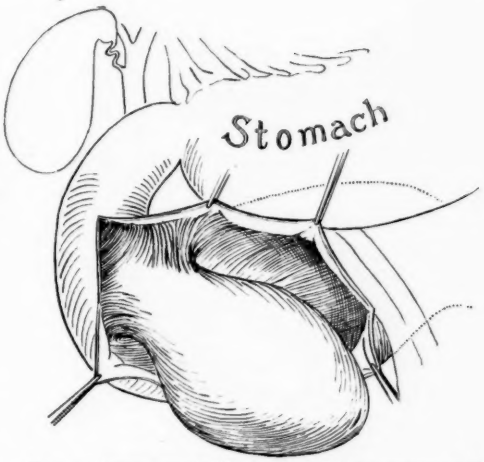

Fig. 1. Diagrammatic illustration of the appearance of the duodenum after it was opened. The polyp was relatively longer and had a more bulbous tip than is shown in this illustration. The slitlike opening is almost as obscure in the illustration as it was in reality. (Courtesy of J. B. Lippincott Co.)

Through the anterior duodenal wall a longitudinal incision about 10 cm. in length was made, whereupon a large polypoid mass was found attached to the posterior wall of the descending portion of the duodenum. The tumor measured 8 cm. in diameter and from 12 to 15 cm. in length; it was covered with what appeared to be normal duodenal mucosa. A slitlike opening at the apex of the tumor was observed. If the edges of the opening were separated a large amount of golden yellow bile was discharged, whereas, if the edges of the slit were not held apart, there would be no discharge of bile even when a considerable amount of pressure was exerted (Fig. 1).

The central portion of the tumor was occupied by a cavity lined with mucosa having the same appearance as the mucosa of the duodenum. There were two small openings into this central cavity; they were 2 mm. apart, one being slightly larger than the other; these were identified as the openings of the

common bile duct and of the pancreatic duct. The cavity within the tumor communicated with the lumen of the duodenum by means of the slitlike opening at the bulbous tip of the tumor.

A circular incision was then made surrounding the openings of the common bile duct and the pancreatic duct. All of the mucosa lining the central cavity was removed except that contained within the circular incision. The greater portion of the mucosa covering the polypoid mass was likewise removed. This resulted in what appeared to be a linear incision of the mucosa of the posterior wall of the duodenum within which was the separate circular island of mucosa derived from the mucosal lining of the central cyst. The mucosa of the posterior wall of the duodenum was then closed to incorporate the island of mucosa surrounding the openings of the bile and pancreatic ducts. By means of a double row of inverting sutures the anterior wall of the duodenum was then closed.

Further operative procedure included the separation of adhesions surrounding the gall bladder and the removal of a few small stones from the latter. Drainage of the gall bladder was effected by means of a small tube placed in the fundus of the gall bladder and brought out by means of a stab wound at the right costal margin. The abdominal incision was closed in layers.

The postoperative course was uneventful. The patient enjoyed excellent health following the operation. Upon roentgenological examination of the gastrointestinal tract a year later only slight dilatation of the upper portion of the jejunum was manifest with no evidence of obstruction.

The explanation of the initial anomaly is not as simple as the title of this report implies. The authors concede that the term, cyst of the ampulla of Vater, is, strictly speaking, incorrect. The outstanding anatomical characteristics of the tumor, the duodenum, and proximal jejunum, as well as the major symptoms present, were due to the intussusception of the cyst. The hypertrophy of the jejunum for a distance greater than the length of the tumor can be explained on the grounds that the bulbous end of the tumor once engaged in peristaltic waves would draw the jejunum onto the intussuscepted mass after its further progress would be impeded by the attachment of its pedicle. Although the slitlike opening in the distal end of the tumor seemed quite analogous to the aperture of the normal ampulla of Vater, and while the common bile duct and the pancreatic duct opened into the cyst, it appears impossible to consider the cyst as having originated from a dilatation of the canal within the ampulla, because the slitlike opening of the cyst into the duodenum was really larger than the aperture of the normal ampulla, and because the cyst was lined with a mucosa which, on both gross and microscopic examination, was identical with the normal mucosa of the duodenum. Also, the openings of the bile and pancreatic ducts were at the distal aspect of the cyst. It appears, therefore, that the abnormality here observed was a congenital anomaly of the duodenal wall and not an acquired dilatation of the ampulla of Vater. The authors state that the term, cyst of the ampulla of Vater, was used in the title of this article because it seemed best suited for making their report available in the current medical indices to those subsequently interested in the subject. This appears to be the first case on record of this anomalous condition.

MATHIAS J. SEIFERT, M.D.

Johnson, W. R.: Chronic, Nonspecific Jejunitis with Unusual Features. *Gastroenterology*, 1943, 1: 347.

The author reports a case of chronic, nonspecific jejunitis which is of interest because of its rarity and because it differs in several respects from the cases of ileojejunitis reported by Crohn. In Crohn's experience the disease almost invariably begins in the distal ileum and progresses proximally; obstruction phenomena are rare, and the accumulation of barium in dilated upper jejunal loops does not occur; and the disease is so extensive that resection is impractical and carries a high risk.

In this case report, the disease process began in the upper jejunum and progressed distally. It produced symptoms of obstruction; caused a delay in the passage of barium through the dilated loops of the upper jejunum; and although episodes of symptoms were present for six years, it remained localized to a short segment of jejunum, which was resected with apparent cure. RAYMOND J. MCGANN, M.D.

Mulsow, F. W.: Meckel's Diverticulum Containing Calculi. Case Report. *Am. J. Digest. Dis.*, 1943, 10: 188.

Among acute abdominal conditions presenting diagnostic difficulties, disease of Meckel's diverticulum ranks high. A review of the literature revealed only 9 previous case reports of calculi in a Meckel's diverticulum. In the early reports these calculi were regarded as gall stones.

Fig. 1. Meckel's diverticulum with stones in it.

A forty-eight-year-old farmer, while at work in the field, was seized with sudden, severe, cramping epigastric pain. He felt faint and perspired profusely. Examination at the hospital revealed a normal pulse, temperature, respiration, and blood pressure. The urine showed a trace of albumin. The white count was 11,300. His chief and only complaint was severe epigastric pain. A medical consultant considered the diagnosis of coronary occlusion. The following morning the white count had risen to 16,000. There was diffuse abdominal pain and muscular rigidity and operation was decided upon. At operation the surgeon discovered a bluish nodular mass to the right of the midepigastrium. This proved to be a large gangrenous Meckel's diverticulum impacted with stones. The appendix was also acutely inflamed.

This diverticulum measured 9 by 6 by 4 cm. The wall was from 5 to 12 mm. in thickness. The cavity contained 5 large faceted brownish stones and a small amount of brownish purulent fluid. The largest stone was impacted in the mouth of the diverticulum. Subsequent x-rays showed that the stones were opaque to the rays. There was extensive gangrene of the lining mucosa of the sac. The patient made an uneventful recovery. JOHN W. NUZUM, M.D

Trasoff, A., and Goodman, D. H.: Some Problems in the Diagnosis of Cancer of the Colon and Rectum. *Am. J. Digest. Dis.*, 1943, 10: 132.

The study presented concerns 120 cases of carcinoma of the colon and rectum, definitely proved by adequate histological study. There is a distinct difference between cancer of the right and left half of the colon as regards the clinical picture and symptomatology. Lesions of the right colon produce as their major symptoms, abdominal pain, weight loss, dyspepsia, and occasional diarrhea. Anemia is frequent and often of a severe grade in about one-half of the patients. A mild leucocytosis is quite common.

The outstanding symptom of cancers on the left side of the colon is constipation, which is seen in about 90 per cent of all cases. Diarrhea may occasionally be present. Abdominal pain and melena are the next most frequent symptoms. The degree of anemia rarely reaches the severity seen in cecal cancers. The constipation found in the majority of lesions on the left side results from the narrower caliber of the left colon together with the more solid form of the feces and the tendency of the growths to be of the encircling and constrictive types. In the right colon, and especially in the cecum, the growth is often larger and ulcerative and does not produce obstructive symptoms because of the larger caliber of the bowel and the liquid content of the feces.

Rectal cancer most commonly causes constipation and melena. Pain in the rectum and lower abdomen is frequently present. It is most important to remember that practically all rectal cancers can be felt by digital examination especially if the patient is standing or straining. The "change in bowel habit" is present in the majority of cases.

The diagnosis of cancer of the colon and rectum was made or suspected in 77 per cent of all patients. In only 2 cases of a series of 49 colon studies by barium enema was the lesion not revealed by the x-rays. It thus appears that a study by barium enema is a highly accurate method of examination of the colon for obstructive lesions. In rectal cancers, the x-rays are not so infallible. Here the proctosigmoidoscopic examination is all important.

It is believed that the diagnosis of cancer of the large bowel in early cases cannot be made on the basis of symptoms and physical examination alone. The x-rays and proctoscopic studies gave accurate findings in close to 98 per cent of the cases. It is therefore important and even imperative that every patient, especially one over forty years of age, who presents persistent gastrointestinal symptoms, should be subjected to careful x-ray and proctoscopic study. Early symptoms of cancer of the colon may respond to medical treatment temporarily, but once the suspicion of cancer is aroused, it should not be lulled by the fact that the patient may feel better for a week or two on symptomatic treatment. The fact that the patient may have had some bowel symptoms for years should not allow the alert physician to think immediately that the trouble is a minor or functional one. This is true especially in patients with rectal bleeding due to hemorrhoids. A plea is made for complete gastrointestinal studies including x-ray and proctoscopic examinations in all patients past forty years of age who present gastrointestinal symptoms. JOHN W. NUZUM, M.D.

Grace, A. W.: Anorectal Lymphogranuloma Venereum. *J. Am. M. Ass.*, 1943, 122: 74.

The author reports the results of his studies of lymphogranuloma venereum at the New York Hospital, New York, since 1932. During this period Frei tests were performed on all in-patients and out-patients who presented signs and symptoms which were regarded as lymphogranulomatous in nature. The incidence was about 1 per 1,000 persons admitted to the hospital.

It was recognized that of all the clinical manifestations those which involve the anorectal region are the most important. They may be, and frequently are, of great chronicity; they are infectious during their period of activity; they are not completely controlled by any form of therapy; they may not become apparent until great structural change has occurred in the bowel wall; they may lead to complete closure of the bowel or to considerable local deformity, and in rare instances may cause death.

Asymptomatic lymphogranuloma venereum occurs about nine times more frequently than does the symptomatic type. The asymptomatic type occurs among those who have other venereal disease.

Two hundred and seventy-six patients showed 348 clinical manifestations of lymphogranuloma venereum. The regions most frequently affected in their order of frequency are the anorectal space, the inguinal region, the genital region, and the lower

urinary tract. More than half of the cases presented anorectal manifestations, of which proctitis, with or without stricture, fistula-in-ano, and perirectal abscess were the most common. Forty-eight and seven tenths per cent of the lesions were in white males (one-third of whom were passive homosexuals), 13.5 per cent were in white females, and 29.5 per cent were in negro females.

The commonest early sign of lymphogranulomatous involvement of the anorectal mucosa is the passage of blood from the anus. This is a direct consequence of the replacement of a portion of the mucosa by granulation tissue; contraction of the fibrous elements of the granulation tissue produces a narrowing of the bowel lumen which may be partial (stricture) or complete (stenosis).

Proctitis without stricture is largely a manifestation of lymphogranuloma venereum while proctitis with stricture is almost exclusively a manifestation of this disease. The development of anorectal lymphogranuloma may be unassociated with, or preceded or accompanied by the occurrence of inguinal adenopathy.

Sulfonamide drugs will cause the regression of lymphogranulomatous inguinal adenitis, either suppurative or nonsuppurative, in approximately five weeks. The manifestation of the anorectal disease which is most responsive to sulfonamide therapy is proctitis. Cases of short duration without stricture can be completely healed. Long-standing cases, and all with stricture require at least one year's therapy with rest periods of from two to three weeks after each course of treatment. A course of treatment consists of 1.5 gm. of sulfathiazole three times daily for two weeks followed immediately by 1 gm. three times a day for three weeks.

EARL O. LATIMER, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Stout, S. L., and Hibbard, J. S.: Perforations of the Gall Bladder Occurring in the General Surgical Practice of a Moderate-Sized Community. *Surgery*, 1943, 13: 734.

Conclusions drawn from a small series of cases warrant the surgical policy of early operation when fulminating acute cholecystitis is suspected.

The constant symptom presented was pain in the gall-bladder region, usually very severe, but not diagnostic of perforation. There was nausea, vomiting, and sometimes jaundice. The onset was acute, but not necessarily cataclysmic. In each of the 6 cases observed there was a history of indigestion, dyspepsia, or gall-bladder colic.

The treatment of suspected perforation of the gall bladder, without exception, should be immediate operation. Therefore, it follows that many cases of acute cholecystitis will be operated upon because of a mistaken diagnosis of perforation. However, immediate cholecystectomy for cases of acute cholecystitis is the procedure of choice. Watchful waiting is not a safe procedure in acute cholecystitis. Perforation is a too frequent occurrence, and it is impossible to predict whether or not an acutely inflamed gall bladder will perforate. Furthermore, localization with abscess formation has not been the rule in cases under conservative management.

Of the 6 patients, only 2 survived, one being operated upon early, the other rather late.

In presenting these cases, the authors were motivated by the desire of demonstrating examples of surgical procrastination. All the patients should have been operated upon much earlier when liver damage was minimal. The advantages of early operation in perforated gall-bladder disease are just as applicable to acute cholecystitis before perforation occurs, since minimal liver damage is present, the lymphatics are sealed by inflammatory edema and exudate, the peritoneum is in a state of acute vaccination reaction, adhesions are not established, the planes of dissection are easily found and separated (often because of marked pericystic edema), and, finally, in case perforation has not occurred, a surgical catastrophe has been prevented.

STEPHEN A. ZIEMAN, M.D.

Boyden, E. A., Bergh, G. S., and Layne, J. A.: An Analysis of the Reaction of the Human Gall Bladder and Sphincter of Oddi to Magnesium Sulfate. *Surgery*, 1943, 13: 723.

Conclusions drawn from the cholecystographic studies on 14 experimental subjects indicated that magnesium sulfate is an effective agent in evacuating the human biliary tract, but it is inferior to egg yolk.

When 30 cc. of a saturated solution are introduced directly into the duodenum within thirty minutes, an average decrease of 42 per cent in the volume of the gall bladder is observed, and the sphincter resistance (3 cm. of water, manometer reading) is lowered. In the same interval, egg yolk lowers the gall-bladder volume 71 per cent and the sphincter resistance 7 cm.

The striking fact that magnesium sulfate acts for the same length of time as egg yolk and merely differs in the degree to which it affects the gall bladder or the sphincter strongly suggests that its mechanism is not local, as hitherto supposed, but hormonal, and that it is absorbed by the intestinal epithelium and causes the formation of a cholecystokininlike substance which stimulates the gall bladder to contract and the sphincter to relax. The fact that it does not cause as deep contraction or as great relaxation as egg yolk may be explained on the basis that magnesium is not absorbed as readily, or that it is not chemically as effective.

Accordingly, it is suggested that magnesium sulfate, like egg yolk, is to be considered as a hormone-producing substance which acts independently, through the blood stream, upon both the gall bladder and the sphincter of Oddi.

The two end organs, however, react differently to a given stimulus. Initially, a dose of either egg yolk or magnesium sulfate usually causes the sphincter to

contract. This, in turn, may interrupt the contraction of the gall bladder which is just getting under way and thereby produce the so-called "two-minute pause." Evidence from animal experimentation suggests that the reason that the hormone acts upon the sphincter for a shorter time than upon the gall bladder is that during fasting the tone of the sphincter is maintained by a local nerve net which has a higher threshold than that of the gall bladder.

STEPHEN A. ZIEMAN, M.D.

Castleton, K. B.: Biliary-Tract Surgery. Survey in Salt Lake City Hospitals, 1930 to 1940, Inclusive. *Am. J. Surg.*, 1943, 60: 190.

This article represents a survey of biliary-tract surgery in the four general hospitals of Salt Lake City for the period extending from January 1, 1938, to December 31, 1940, inclusive. The survey was conceived with the idea that such a study might prove of interest and value since it differs from most studies of biliary-tract surgery in several important particulars. Most such studies come from large clinics, hospitals, or groups in which the work is done by a few highly trained surgeons under ideal or nearly ideal and uniform conditions. This study, on the other hand, represents the work of a comparatively large group of surgeons (77) with variable techniques not only in the operation itself but also in the preoperative preparation and postoperative care. It represents a total number of 411 operations on 401 patients.

The ages of the patients in this group varied from nineteen to eighty years and the average for the entire group was forty-eight and two-tenths years. There was just one patient under the age of twenty (nineteen) and 20 others under the age of thirty years. There were 87 males and 314 females or a ratio of 21 per cent males to 79 per cent females. This is in line with other published reports, although many series give a higher proportion of males than is present in this series. Of the 411 patients operated upon 288 were found to have stones either in the gall bladder or the ducts, or both; 113 did not have stones. The proportion of stoneless cases in this series is high compared with most reported series. Eighty-nine patients of this series had acute cholecystitis, an incidence of 21.6 per cent.

As to the type of surgery, there were 301 cholecystectomies among the 411 operations (73.2 per cent), 61 cholecystostomies (14.8 per cent), 33 cholecystectomies with choledochostomy (8.0 per cent), 5 cholecystostomies with choledochostomy (1.2 per cent), choledochostomy alone in 2 (0.4 per cent), 3 plastic operations on the common duct (0.7 per cent), and 1 cholecystduodenostomy, 1 cholecystgastrostomy, and 4 cases of exploration with lysis of adhesions around the gall bladder.

The common duct was explored in only 9.7 per cent of the cases (excluding 3 cases of plastic operation of the duct). This is low according to present indications. The mortality rate for this group, however, was quite high (15 per cent).

The mortality rate for the entire group was rather high, being 7.2 per cent per patient and 8.05 per cent per operation.

In considering these facts and figures one cannot help but arrive at the conclusion that common-duct surgery (and we must necessarily include gall-bladder surgery in general, since one cannot know beforehand which cases will need exploration of the common duct) should be done only by well trained experienced surgeons. JOSEPH K. NARAT, M.D.

MISCELLANEOUS

Van Liere, E. J., and Northup, D. W.: The Emptying Time of the Normal Human Stomach in the Young Adult. *Gastroenterology*, 1943, 1: 279.

The authors point out that nowhere in the literature can one find data based on well controlled experiments which give the normal gastric emptying time in the various decades of life, and that data so procured, although extremely helpful to the clinician, are often not precise enough for research purposes.

The normal gastric emptying time was determined by well controlled fluoroscopic studies in 69 healthy adult males between the ages of twenty and thirty years. The test meal consisted essentially of 15 gm. of Quaker farina which had been boiled in water from a volume of 350 to 200 cc. Fifty grams of barium sulfate were added.

The controlling factors were: uniformity of the test meal, observations following a night of fasting, relatively stable environmental temperature, permission for smokers to smoke cigarettes after the meal, elimination of any premedication with home remedies such as cold capsules likely to contain atropine or ephedrine, and the general buoyancy of health in the subjects given the test meal. Certain uncontrollable factors may have crept in, but these were minimized by repetition of the observations several times on the same individual.

The results of these observations were graphically shown in an accompanying distribution curve. The curve was positively skewed which indicated that there are somewhat more individuals who have a relatively rapid gastric emptying time, although in a much larger series the skewness of the curve might disappear.

The average, i.e., the arithmetic mean, of the gastric emptying time for the 69 young adults was 2.13 hours, the median 2.08 hours, and the mode 2.09 hours. The extremes ranged from 1.50 to 3.30 hours.

The article included a comprehensive bibliography.

JOHN E. KIRKPATRICK, M.D.

Hoelzel, F.: Gastric Acidity, Nutritional Hydration, and Appetite. *Am. J. Digest. Dis.*, 1943, 10: 121.

Data secured during a period of undernutrition and of re-alimentation revealed a relation between the fasting gastric acidity and the degree of general hydration. Such a relation also explains changes in gastric acidity which were found to occur in connection with short fasts, prolonged fasts, and variations

in the protein intake. A relation between gastric acidity and hydration likewise explains decreases in appetite and in food tolerance which were found to be produced by restricting the food intake too much or by too frequent fasting. J. M. MORA, M.D.

Ravdin, I. S., Thorogood, E., Riegel, C., Peters, R., and Rhoads, J. E.: The Prevention of Liver Damage and the Facilitation of Repair in the Liver by Diet. *J. Am. M. Ass.*, 1943, 121: 322.

A great deal of attention has been given to the constituents of the diet for patients suffering from chronic or acute disease of the liver. Experimental evidence was presented, nearly twenty-five years ago, which suggested that a diet high in carbohydrate offered direct protection of the liver from the necrotizing effects of chloroform. Such experiments led the clinicians to conclude that high concentrations of liver glycogen would protect the liver from injury. Nevertheless, little attention has been focussed on the quantity of carbohydrate ingested.

This article is based upon data obtained from a series of 127 patients suffering from liver disease secondary to pathology in the common duct or gall bladder. Of this group, 37 were maintained for five days or more prior to operation on a diet adequate in composition and in caloric value. In the latter group chemical analyses of the liver tissue were obtained from specimens secured at operation. Glycogen and fatty-acid content were determined on these biopsied samples and indicated that the patients in this group did not suffer from severe liver glycogen depletion or extensive infiltration of liver fat.

The average lipid content of the 37 patients who were prepared for five days or longer was 4.2 per cent, while the glycogen content was 3.3 per cent. A series of 10 patients suffering severely from liver damage and who were not prepared by diet, demonstrated a liver lipid content of 14.2 per cent and a glycogen concentration of 2.8 per cent. The diet administered consisted of 20 per cent protein, 74 per cent carbohydrate, and 6 per cent fat. An adequate caloric intake was maintained by frequent feedings so that generally 3000 calories a day were consumed. Prior to operation the protein content of the diet was in the form of casein. Following operation calves liver was administered on the basis of experiments of Vars and Schultz, which indicated that liver most effectively aided in the regeneration of hepatic tissue.

The authors concluded that by their dietary management a better and more rational form of therapy is afforded than when glucose alone is given.

J. GARROTT ALLEN, M.D.

GYNECOLOGY

UTERUS

Norment, W. B.: A Study of the Uterine Canal by Direct Observation and by Means of a Uterogram. *Am. J. Surg.*, 1943, 60: 56.

The author notes that the study of uterine bleeding from an endocrine viewpoint has made much progress during the past few years. However, the detection of uterine polyps or submucosal myomas as a possible cause of uterine bleeding is very difficult. Probably no other organ is more susceptible to new growths, and offers less means of detecting them, than the uterus. X-ray studies or other laboratory methods are at our disposal for the diagnosis of tumors in other systems of the body. However, a submucosal myoma or polyp is usually found with the curet, which is an uncertain method. The author describes a method whereby direct observation of a submucosal myoma protruding into the uterine canal, or a polyp of the uterus may be made. A thin rubber tissue bag is attached to a special foroblique telescope and inserted into the uterine canal. The bag was then inflated with air. By this means the uterine canal could be visualized as the rubber tissue bag is transparent when moistened. The second method of studying the uterine canal is by means of the uterogram. A small rubber tissue bag is attached to a No. 18 catheter. This is inserted into the uterus with the idea that a polyp or submucosal myoma protruding into the canal will depress the bag and reveal the defect by x-ray study. The details of the technique for this x-ray study are described.

The advantages of this procedure over the usual method, a salpingogram made by instilling dye into the uterine canal, are that the numerous folds of the uterine canal are pressed out so the bag can be inserted, the tubes are clamped and different angle x-ray studies of the uterine canal can be made, which would be impossible with a salpingogram. With this method there is no leakage of the dye out of the cervical canal or the fallopian tubes. There is a constant pressure in the uterine canal when the bag is used so that repeated x-ray studies from different angles give contours of the same size, which may be compared with each other. No ill effects of this method have been seen.

The author notes that there are many variations in the so-called normal uterine canal. Basically, it is, of course, an inverted triangle, but the proportions are often distorted to a certain extent in a normal canal. These are easily recognized after frequent use of the bag. For instance, one cornu might protrude further than the other cornu, or in an antiflexed or retroverted uterus, the length of the triangle may be shortened. However, a growth of any proportion should distort the bag so there should not be much doubt of its presence. This method of study is valuable in the case of uterine bleeding in which a definite fibroid is palpable, as it will help determine whether the fibroid is the real cause of the uterine bleeding. The packing when arranged this way may be used to control bleeding from the uterine wall by keeping it inflated for a number of days. It is a more desirable way than the method by which the uterine canal is packed with gauze.

Another use for the uterine bag is that of determining the presence or absence of involvement of the uterus when large abdominal masses fill the pelvis, in those patients in whom it is difficult to determine whether the mass originates from the uterus or whether it is extrauterine.

HERBERT F. THURSTON, M.D.

Bowing, H. H., and Fricke, R. E.: Cancer of the Uterus. *Am. J. Roentg.*, 1943, 49: 487.

Brilliant improvement in surgical technique has developed the radical operations for cancer of the uterine fundus and for early cancer of the cervix to a high degree of efficiency. Results in well selected cases are excellent, and the operative procedures have become standardized in the hands of leading surgeons everywhere. The value of the present surgical technique has been proved and it is likely that no changes in the surgical approach will ensue.

In this study no new data have been presented, but the authors are submitting a conception or perhaps a "philosophy of treatment," which they have held for a long time. It seems very evident that to careful radium therapists the treatment of cancer of the uterine cervix is an individualized scheme. Not only do different clinics have varying methods of treatment, but the same radiologist will alter his method of attack on different lesions, because the lesions vary greatly and also because the rate of response to treatment probably differs with the amount of defensive factors of the patient's tissues against cancer. It is well known that radium can be used as cautery, or, if differently applied, will exert not a caustic but a healing effect, to which the reactions of the normal tissue greatly contribute. The latter effect is the most desirable in that it maintains to the highest degree possible the normal integrity of the tissues in and near the involved malignant field.

Cancer of the uterine fundus presents the problem of a hidden lesion which is inaccessible for accurate estimation of its extent. Herein, to date, radium treatment has been rather standardized, and has consisted of homogeneous irradiation along the entire length of the uterine canal. Even though the percentage of "cures" or "arrests" secured with radium treatment alone has been encouraging, radiologists have put forth every effort to individualize the treatment. Heyman's multiple-tube technique, the Schmitz Y-shaped applicator, and the

Friedman hysterostat are specific instances of this effort. This is encouraging, although in view of the nature of carcinoma of the uterine fundus, these efforts will probably always be limited.

Radium treatment of cancer of the uterine fundus yields encouraging results, and in the course of time further advances in technique may succeed in creating a more flexible, less standardized program of treatment, and may produce even superior results, comparable to those achieved by radium therapy in cancer of the uterine cervix.

The following conclusions are drawn:

1. The extent of the primary malignant lesion of the uterus is the most valuable prognostic factor.

2. The grade of malignant change (Broders' index) is a very valuable prognostic determination when more standardized surgical and radium therapeutic techniques are employed. This observation does not seem to be entirely true when individualized radium therapy is employed in cancer of the uterine cervix.

3. Evidently, the most individualized radium therapy designed to meet the demands of the patient under treatment for cancer of the uterus will give the best result.

Healy, W. P., and Twombly, G. H.: Cancer of the Cervix. *Am. J. Roentg.*, 1943, 49: 519.

Nine hundred and twenty cases of primary carcinoma of the cervix observed in the Memorial Hospital in New York from 1932 to 1937, inclusive, are reported and reviewed. The peak in the age incidence in this group lay between forty and fifty-five. Only 24 of the 920 patients were single and of these 6 admitted that they had borne children. Of foreign-born patients, Italians showed the highest incidence of cervical cancer. Negroes formed 8.5 per cent of the group. Only 46, or 5 per cent, of the patients were jewish in spite of the large number of jews in the population of New York City.

Comparable groups of cases treated exactly the same as far as the kind and amount of radium were concerned, except for the type of external roentgen therapy received, showed that the so-called "divided-dose technique" gave a 35.4 per cent five-year cure rate, while the "massive dose technique" gave a 28.5 per cent rate. These differences are rather more than less marked if the statistics are corrected for the extent of disease, age distribution, or histopathological classification in the two groups. That the difference in cure rates is real is further suggested by larger numbers of cases followed up only three years in which again a decided increase in cure rate was seen in those receiving the divided-dose therapy.

It should be noted, that the total amount of roentgen radiation delivered to the parametrium in the divided-dose type of treatment is much greater than that given by the massive-dose type. The tissues lying next to the walls of the pelvis receive less than one threshold erythema dose of radiation when a radium bomb and tandem alone are used. With the massive-dose type of treatment these tissues receive from 0.8 to 2 threshold erythema doses. When the divided-dose technique is used and 12 x 200 roentgens (2,400) are delivered at 70 cm. to each of six fields, the same areas receive 4 to 7 threshold erythema doses. Of course, it must be remembered that massive-dose technique requires only a week or less for delivery of the full dose, while divided-dose therapy usually requires thirty-six treatment days, or six weeks. Thus, the increase in dose to the parametrium is probably less than shown arithmetically if one considers the factor of biological recovery which takes place in such a treatment interval.

JOSEPH K. NARAT, M.D.

Schmitz, H. E., Sheehan, J. F., and Towne, J.: The Effect of Preoperative Irradiation on Adenocarcinoma of the Uterus. *Am. J. Obst.*, 1943, 45: 377.

The technique is given for the treatment of carcinoma of the uterine fundus by combined x-ray and radium therapy, as employed at the Mercy Hospital Institute of Radiation Therapy, Chicago, Illinois.

A group of 77 proved cases of adenocarcinoma were divided into 2 groups: those receiving preoperative and those receiving postoperative irradiation. The patients receiving preoperative radiation therapy were grouped clinically and graded microscopically.

Eleven patients receiving preoperative irradiation were hysterectomized. Five of the uteri adequately treated according to this method were free of carcinoma. Serial blocks of 4 of these 5 uteri failed to reveal residual carcinoma. All of the remaining 6 patients considered as inadequately treated had active carcinoma remaining in the uterus.

The 27 remaining patients, irradiated but not hysterectomized, add further evidence, as demonstrated by curettage or follow-up, that adequate irradiation in clinical Group I or II carcinoma of the fundus has a definite value.

Although the authors cannot advocate this treatment as a substitute for surgery in patients who are good surgical risks, they believe that the plan of preoperative irradiation should be carried on until sufficient case records are on hand to determine whether the five-year salvage is greater than in cases treated by surgery and postoperative irradiation.

EDWARD L. CORNELL, M.D.

EXTERNAL GENITALIA

Strauss, H., Horowitz, E. A., and Grunstein, I.: Cervical Secretion in Chronic Gonorrhea in the Prostitute. *Am. J. Obst.*, 1943, 45: 840.

A single gynecological examination just before admission to the hospital revealed clinical evidence of infection in only 30 per cent of a group of prostitutes culturally positive for the gonococcus, as compared to 85 per cent when the patients were repeatedly examined in the hospital. Cultures for the gonococcus were taken before the institution of treatment from 65 women with chronic gonorrhea who had had positive cultures just before admission.

Only 60 per cent were found positive on repeated culture examinations, while a single culture was positive in only 45 per cent. In view of the findings in untreated cases, the limitations of the culture in the diagnosis of chronic gonorrhea are obvious. A few negative cultures have limited value in ruling out the diagnosis, or as proof of cure.

Of the clinically positive patients treated with sulfathiazole, 63 per cent still had moderate or profuse mucopurulent cervical discharge when examined three weeks later, although gonococci were no longer found on culture. The greater value of the culture as compared to the smear, in chronic gonorrhea, was again demonstrated. Trichomonads were found in two-thirds of the cases, and persisted in spite of sulfathiazole therapy. The presence of trichomonads should not be the cause of overlooking a possible gonorrhea. EDWARD L. CORNELL, M.D.

MISCELLANEOUS

Jacoby, A., and Rabbiner, B.: Clinical Evaluation of Testosterone Propionate and Methyl Testosterone in Dysmenorrhea and Menometrorrhagia. *Am. J. Obst.*, 1943, 45: 697.

Eighteen patients with dysmenorrhea and 9 patients with menorrhagia and menometrorrhagia were treated with testosterone propionate and methyl testosterone. Complete relief of symptoms was experienced by 4 and improvement by 8 of the dysmenorrhea patients and complete relief by 6 and improvement by 2 of the menometrorrhagia patients. Thus, androgen therapy was completely or partially effective in 67 per cent of the dymenorrhea cases and in 88 per cent of the menometrorrhagia cases. Practically, in all instances there was a recurrence of the original ailment after discontinuation of treatment at varying intervals.

Oral androgenic therapy, if administered in adequate dosage, yields the same result as parenteral therapy. EDWARD L. CORNELL, M.D.

Lankford, C. E., and Cooke, W. R.: A Minimum Bacteriological Criterion of Cure of Gonorrhea in Women. *Am. J. Obst.*, 1943, 45: 685.

The problem of establishing cure of gonorrhea in the female with a reasonable degree of assurance has always been difficult, both from the clinical and the bacteriological viewpoint. A further complication to this uncertain problem is the tendency of certain of the sulfonamides to effect clinical subsidence of the infection without elimination of the gonococcus.

Repeated cultures may be necessary to demonstrate the gonococcus in chronic and latent infections, particularly following chemotherapy. Negative smears have no value as a bacteriological test for cure, and indeed the smear might well be abandoned altogether for this purpose. On the basis of data presented, it would appear that 6 successive cultures will detect a high percentage of residual gonococcal infections. It is suggested that a *minimum* of 6 negative cultures be obtained before a patient is released from observation.

EDWARD L. CORNELL, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Sloman, L.: The Hippuric-Acid Excretion Test in Pregnancy. *Med. J. Australia*, 1943, 1: 293.

One hundred and seventy-seven pregnant women and 70 puerperal women were tested for their ability to excrete hippuric acid after the oral administration of 4 gm. of sodium benzoate. The patients tested included both normal pregnant women and those with complications of pregnancy.

In normal pregnancy the amount of hippuric acid excreted is less than that of normal nonpregnant people.

In the majority of cases the amount of hippuric acid excreted reaches Quick's figure for normal after about the eighth day of the puerperium.

The hippuric-acid excretion rate of normal women up to three months of pregnancy is within the range for normal nonpregnant people. For normal women from three to six months pregnant there is a decrease in the rate of excretion of hippuric acid, but the mean excretion rate is still within the range for normal nonpregnant subjects. For normal women from six to nine months pregnant there is a further decrease in the excretion rate, the mean excretion rate being less than the lower level of the normal excretion rate of nonpregnant women. The hippuric-acid excretion rate rises in the majority of cases during the puerperium.

In cases of toxemia of pregnancy, the mean excretion rate of hippuric acid was not statistically significantly less than the mean in normal pregnancy. The majority of patients suffering from toxemia of pregnancy failed to reach Quick's figure for normal excretion by about the tenth day of the puerperium. There is statistically a highly significant difference between the means of the tests carried out during the puerperium on toxemic patients and the means of the tests carried out during the puerperium on normal patients.

In cases of albuminuria of pregnancy not associated with hypertension, the mean hippuric-acid excretion rate was lower than in normal pregnancy, but the difference between the means was not statistically significant. Most patients with albuminuria of pregnancy had an increased rate of excretion by the eighth day of the puerperium, and the mean excretion rate was statistically not significantly lower than that of the puerperium of normal patients.

In cases of hypertension of pregnancy not associated with albuminuria, the mean excretion rate of hippuric acid was not statistically different from the normal for the latter months of pregnancy. The majority of patients had an increased rate of excretion on or about the eighth day of the puerperium, and although the mean excretion rate had not reached the normal level for nonpregnant people by that time, the difference between this mean and the mean for the puerperium of normal patients was not statistically significant.

Seven patients with pyelitis of pregnancy were found to have a diminished rate of excretion of hippuric acid which was statistically highly significant. In 2 cases tests repeated during the puerperium after the urine had become sterile revealed a pronounced increase in the rate of excretion of hippuric acid, the excretion rate approaching the normal figure for nonpregnant people. The low hippuric-acid excretion rate during the pregnancy of these patients was due to kidney dysfunction.

Three patients with hyperemesis gravidarum were tested. Two in the first three months of pregnancy had a low excretion rate, but it was not significantly lower than the mean for normal pregnancy for this period. The third patient at thirty-nine weeks had an excretion rate well within the range for normal pregnant women during that period. The test was repeated in this case during the puerperium and the excretion rate had risen to Quick's normal.

The rate of excretion of hippuric acid may be low in normal or complicated pregnancy. The cause of the low figures is not apparent. In the present state of knowledge, a poor rate of excretion of hippuric acid has no obvious prognostic or diagnostic significance.

CHARLES BARON, M.D.

Browne, F. J.: Vitamin B_1 in the Prevention of Pregnancy Toxemia. *Brit. M. J.*, 1943, 1: 445.

Vitamin B_1 was given to 100 women who were pregnant for not more than twenty weeks, and continued till term. Alternate cases were taken as controls. To the treated women 1 tablet containing 3 mgm. of vitamin B_1 (aneurin hydrochloride) was given daily. As each milligram represented 320 I.U. of B_1 the total daily dose given to each patient was 960 I.U. In course of the investigation a certain number of patients dropped out through various causes—miscarriages or removals—so that in the end there were left 169 women, including 88 who were treated and 81 controls.

In assessing the incidence of toxemia in the two groups two different standards of toxemia are taken: (1) a blood pressure of 130/70 (standard I); (2) a blood pressure of 140/90 or over, or any blood pressure of over 130/70 if accompanied by albuminuria (standard II). Of treated patients there were 32 (36.3 per cent) who had a blood pressure exceeding 130/70, excluding patients with chronic hypertension. Of the control patients 20 (24.6 per cent) had a blood pressure of 130/70. Of the treated patients there were 7 (7.9 per cent) who had a blood pressure of 140/90 or over, or a blood pressure of over 130/70 with albuminuria. Of the controls there were 4 (4.9 per cent) who were toxemic according to this standard.

These negative results might be explained in one of two ways: (1) that B_1 deficiency does not play any

part in the causation of pre-eclamptic toxemia, and (2), that the diet of the women included in this experiment was not deficient in vitamin B_1. In this connection it may be noted that McCance and his coworkers (1938) in an investigation of the diets of 120 women who were pregnant from three to nine months and in varying income levels found that all, even those in the higher income groups, received suboptimal amounts of B_1, the estimated daily intake varying from 209 to 454 I.U., as compared with an optimal intake of from 600 to 900 I.U.

The conclusion to be drawn from this experiment is that so far as the prevention of toxemia of pregnancy is concerned, no beneficial effect is obtained by supplementing the diet with vitamin B_1.

CHARLES BARON, M.D.

Dexter, L., Weiss, S., Haynes, F. W., and Sise, H. S.: Hypertensive Toxemia of Pregnancy. Pre-Eclampsia and Eclampsia. *J. Am. M. Ass.*, 1943, 122: 145.

This study is based on observations on 100 normal pregnant women, 100 patients who presented generalized edema uncomplicated by hypertension during pregnancy, and 80 patients with definite hypertension during pregnancy.

Approximately 75 per cent of all the pregnant patients had easily demonstrable generalized edema which was only rarely of pathological significance to the mother or fetus in the absence of hypertension and albuminuria. Its cause is unknown. Ninety per cent of the previously normal patients had no vascular complications during pregnancy and 50 per cent of previously hypertensive or albuminuric patients suffered no aggravation of their hypertension or albuminuria during pregnancy—this without regard to the degree of hypertension or albuminuria present before pregnancy. Although the mother fared well in this group of cases, there was a high incidence of miscarriages and stillbirths.

From 6 to 9 per cent of the previously normal patients had hypertension or albuminuria in the latter half of pregnancy (pre-eclampsia, or if coma or convulsions occurred, eclampsia). Fifty per cent of the previously hypertensive patients had toxemia in the latter half of pregnancy. It was impossible for the authors to predict which hypertensive patient would show symptoms of toxemia.

Toxemia of pregnancy is an acute vascular disorder of the latter half of pregnancy which disappears before or soon after delivery. Clinically, it resembles closely acute glomerulonephritis in respect to hypertension, albuminuria, and generalized edema; frequently there is the development of a permanent vascular disease subsequently.

Generalized edema during pregnancy and prepregnant hypertensive vascular disease are the most important predisposing factors in the development of toxemia.

The immediate mortality in pre-eclampsia is almost negligible, while in eclampsia it is high in the country at large.

Although the fetus shows no late effects of the toxemia, permanent hypertensive cardiovascular renal disease occurs in approximately 25 per cent of the patients with toxemia of pregnancy.

Post-toxemic hypertension and albuminuria are conditioned more by the duration of toxemia during pregnancy than by its severity. The authors advocate termination of the pregnancy when toxemia, no matter how mild, has persisted for three weeks in spite of conservative therapy.

Clinically and pathologically post-toxemic hypertension differs in no essential detail from other types of chronic hypertensive disease. At post-mortem examination the characteristic lesions consist of nephrosclerosis.

The most characteristic and constant pathological lesions in toxemia are in the kidney and consist of a glomerulonephrosis. Liver lesions are inconstant. Placental lesions are characterized by infarction.

Excessive sedation and venesection can be dangerous. Interruption of the pregnancy after three weeks of conservative therapy to prevent the occurrence of permanent vascular disease in the mother is advocated.

The etiology of the toxemia of pregnancy is unknown, although evidence seems to point to the placenta as being primarily responsible for the condition.

HENRY C. FALK, M.D.

LABOR AND ITS COMPLICATIONS

McIntyre, W. K.: Further Notes on the Control of Post-Partum Hemorrhage by Injection of the Umbilical Vein. *Med. J. Australia*, 1942, 2: 517.

Attention is drawn to the value of the Mojon-Gabaston cord-injection technique in the treatment of retained placenta and post-partum hemorrhage.

The technique of the procedure is briefly described, emphasis being laid on the importance of hot saline solution for the injection (temperature between 52.5°C and 54°C); from 500 to 1,000 cc. are required.

The results of using the method in a series of 51 cases are discussed briefly and analyzed.

In this series the proportion of cases in which injection was used was about 1 in 12. This figure is probably higher than would be found necessary in general practice. The results may be tabulated as follows:

Spontaneous delivery during injection	6 (11.8 per cent)
Placenta expressed immediately after injection	24 (47.1 per cent)
Placenta expressed within five minutes after injection	15 (29.4 per cent)
Partial failures	4 (7.8 per cent)
Failures	2 (3.9 per cent)

DANIEL G. MORTON, M.D.

Barns, H. H. F.: Maternal Birth Palsy Due to Trauma. *J. Obst. Gyn. Brit. Empire*, 1943, 50: 13.

Maternal birth palsy due to trauma is a rarely reported complication of labor. The paralysis affects

part or parts of the lower limb of the mother, appears early in the puerperium or during labor itself, and is caused by trauma to the nerves traversing the pelvis, more commonly the sacral plexus.

Huenermann considered that the lumbosacral cord, as it passes over the ala of the sacrum, is injured by pressure, and that since this cord chiefly forms the main portion of the common peroneal nerve, the injury is manifest by paralysis of the muscles supplied by this nerve. The gluteal muscles, which are also supplied by dorsal branches of the lumbosacral cord through the superior gluteal nerve, are not infrequently paralyzed as well.

The pressure theory is criticized by Lambrinudi. He suggests that the mechanism of this condition is that of traction on the lumbosacral cord, and that the lesion is probably located in the roots of this nerve rather than along its course. This theory would account for both the antepartum sciatic pains and the rate post-partum paralysis, because the loosening of the sacroiliac joints, which permits the sacrum to rotate, occurs in the latter part of pregnancy.

The author believes that the part of the fetal head occupying the posterior segment of the inlet of the pelvis may compress the lumbosacral cord in cases in which there is true disproportion or when, from some cause, the fetal head is deflected to one or the other side of the pelvis. In such cases the nerve is exposed to pressure provided that the part of the pelvic brim formed by the ala of the sacrum and the posterior half of the ilium has a gentle curve, concave anteriorly, and the promontory of the sacrum is not unduly prominent.

The pressure is likely to be greatest when the head is tightly fixed and the uterine contractions are strongest. This will usually be when the 2nd stage of labor is being approached or has actually arrived. When traumatic paralysis follows delivery by the forceps, the injury to the nerves probably arises more commonly from pressure exerted by the fetal head, which is already active before the instrumentation and is increased by the force exerted by the obstetrician through the forceps when there has been little change in the obstetrical position of the head.

Bilateral traumatic paralysis which occurs rarely is probably to be explained, as Linden suggests, by the repeated application of the forceps in difficult labor when the position of the head is altered between the applications so as to affect first one side and then the other.

If traction were the mechanism, as Lambrinudi suggests, then there is no valid reason why the lesion should not be bilateral in all cases, for any movement of the pelvis on the sacrum is likely to be equal or almost equal on the two sacro-iliac joints.

Three cases of traumatic birth palsy in the mother are reported. In all, the common peroneal nerve was affected. The labors were prolonged and were terminated by operative measures. The mothers experienced pain in the leg during the labor. The paralysis was present from the commencement of the puerperium. The second patient was aware of a feeling of weakness of the leg during labor. Paresthesia in the form of a dead feeling, or a feeling of pins and needles preceded the loss of motor power. Hyperesthesia, hypesthesia, or complete sensory loss, may be detected, according to the severity of the nerve injury.

Prevention of traumatic birth palsy in the mother is extremely difficult. It is impossible to predict that a patient will acquire the lesion until she develops the warning symptoms of pain and cramps or paresis in the leg during labor, but the possibility of its occurrence in a trial labor should be remembered. When the warning symptoms appear in a patient during labor, the danger of instrumentation should be borne in mind and delivery by Cesarean section considered if the child is normal and alive.

The essentials of treatment of the palsy are:

1. Careful splinting of the limb to prevent the occurrence of deformity and to hold the joints in such a position as to relax the affected muscles, without, however, overlengthening the unaffected muscles.

2. To preserve the tone and nutrition of the muscles of the limb by encouraging voluntary, active movements of the limb. Such movements are more effective than massage and electrical stimulation.

3. To prevent stiffness of the immobilized joints by a daily period of passive joint movements.

DANIEL G. MORTON, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Macpherson, A. I. S.: Acute Puerperal Breast Abscess. Clinical Observations upon Its Etiology and a Suggested Method of Treatment. *Edinburgh M. J.*, 1943, 50: 25.

Twenty-six consecutive cases of acute puerperal breast abscess admitted to a general surgical ward are briefly reviewed. In the etiology of puerperal breast infection, incomplete emptying of the breast and stasis of milk are of great importance. These conditions inevitably follow poor nursing technique or ill-controlled weaning. Cracked nipple, on the other hand, is by itself an infrequent causative factor (4 cases). In only 1 or 2 patients at the time of admission was there any evidence at all to suggest that the breast infection was metastatic. The general condition of these patients was not good. The staphylococcus aureus was by far the most common causative organism (from 18 to 20 cases).

Prophylaxis should therefore be directed chiefly toward maintaining the antenatal health of the mother and ensuring the proper management of breast feeding by careful supervision for not less than four weeks after parturition.

A method of treatment which aims at the minimum of interference after incision is described. Incision is delayed till localization is certain. Localization can be encouraged by the use of dry heat.

At operation a small incision, about 1½ in. long, is made, pus is evacuated and all "loculi" are broken down. The cavity is then cleaned with a spirit swab and packed firmly with gauze which may be treated

according to the predilections of the surgeon. A firm supporting bandage is applied, and is kept comfortable by daily adjustment.

The dressing is left undisturbed for five days. At this time the wound often shows little sign of inflammation and the pack is comparatively dry. In these cases, and in others in which the pressure of the pack is causing redness and edma at a distance from the wound, the pack is removed quickly in two or three days. When pus is oozing around the pack, when other signs of inflammation are still apparent, or if the cavity has been a large one, the pack is removed more slowly over a period up to ten or fourteen days. After removal of the pack a wick of gauze is inserted to allow the cavity which remains to granulate outward from the depths. This granulation progresses rapidly, and epithelization is complete in a further one to three weeks, according to the size of the cavity and the dryness of the breast.

By dispensing with the necessity for frequent dressings it is believed that (a) the postoperative comfort of the patient is greatly increased, (b) the chances of reinfection of either breast and of cross infection are reduced, (c) healing progresses satisfactorily and the recurrence rate is low, and (d) the prospect of maintaining lactation (if this is desirable) safely for mother and child is improved. In all deep or extensive breast abscesses, however, it is wise to suppress lactation completely. This is most satisfactorily done, and healing thereby undoubtedly accelerated, by the early and adequate use of a synthetic estrogen preparation. DANIEL G. MORTON, M.D.

NEWBORN

Hartley, J. B., and Burnett, C. W. F.: A Study of Craniolacunia. *J. Obst. Gyn. Brit. Empire.*, 1943, 50: 1.

Craniolacunia (Lueckenschaedel, relief skull, lacunar skull) is characterized by an abnormal development of the bones of the vault of the skull, in which thick bony bars or ridges are formed on the inner surface of both squamous temporal, parietal, and frontal bones, and of the squamous occipital bone. These bars run a variable course from case to case, sometimes diverging and then converging, forming a network so as to enclose between them lake-like areas, where ossification is diminished or absent and where the thickness of the bone is correspondingly reduced. Sometimes the bars are broad and dense, with the lacunae poorly defined or shallow, sometimes (as in hydrocephalic skulls) the lacunae are large, very numerous, and relatively deep, the bars being of varying thickness. The outer surface of the bones is smooth, and the lacunar appearance is seen only by roentgenography in vivo, or by roentgenography, transillumination, and direct inspection after death. This lacunar appearance may be so marked as to permit confident roentgenological diagnosis at the seventh month of fetal life or so slight as to be dubious on good roentgen-ray films taken in early infancy.

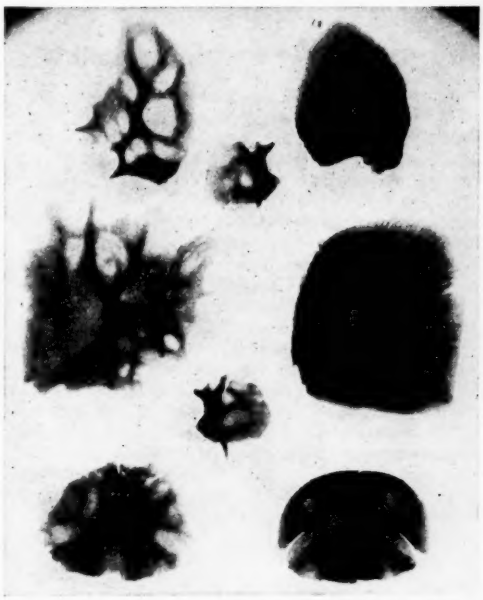

Fig. 1. Contrasting roentgenograph of dried skull bones showing the normal structure of the vault bones at thirty-seven weeks as compared with the faulty architecture seen in craniolacunia at the same stage of development.

The theories which have been advanced in the past by various authors to account for craniolacunia can be broadly classified into the three following groups:

1. Theories of inherent developmental defect
2. Theories of causal disease
3. Theories of pressure disturbance

Evidence derived from this study throws considerable new light upon these earlier theories. Engstler's proposition that the developmental defect is due to the diminution of blood supply resulting from occlusion of the vertebral arteries would not explain the frequently associated spinal defect.

It cannot be an expression of delayed development because the bars and ridges of a craniolacunar skull in a fetus of eight months (Case I) were thicker than the bones of the normal skull at term. It is thus a disorder of development and not a simple underdevelopment.

All observers have stressed the frequent association of craniolacunia with other developmental defects such as talipes and spina bifida, which may be either myelocele or meningocele, single or multiple, small or large, and may occur in any region of the spine. Encephalocele is also described. All these types of defects occurred in this series.

The authors agree with Vogt and Wyatt that the frequency with which these apparently developmental anomalies are associated with craniolacunia supports the view that they may all result from an

inherent developmental defect, which mainly involves the various parts of the enfolding mesoblastic layer of the skull and spine.

Few authors have supported the theory of a disease process being the causative factor. Hughes alone has suggested that rickets and syphilis might be responsible. Roentgenological examination of the skulls of known syphilitic infants has not once revealed the presence of craniolacunia. The authors have not found any clinical or roentgenological evidence of rickets in any of their cases. Heredity, the age and degree of parity and general health of the mother have no bearing on the etiology. Neither the sex of the infant nor fetal mortality is of significance. Pre-eclamptic toxemia had no relation to the condition. Hydramnios is well known to accompany fetal deformities, so that its occurrence in this series is not surprising.

The explanation of the lacunar changes in the vault bones of the skull which has attracted the greatest number of adherents is that based upon the supposition of abnormal pressure bearing upon the developing skull, either from without or from within.

The theory of increased pressure upon the bones from within was based on the pure assumption that the lacunae corresponded to and were produced by the cerebral convolutions, and that they were analogous to the "thumbing" which has been so widely accepted in the past as evidence of internal hydrocephalus.

The findings in Case I of this series completely disprove this theory, because at post mortem it could be seen that the gyri did not fit into the lacunae; the bony bars were crossed at all angles by the convolutions and the two patterns were entirely dissociated. Furthermore, there was no evidence of increased intracranial pressure having existed.

Craniolacunia must, the authors believe, be due to a developmental defect in which two processes are frequently associated, namely the faulty ossification of the primitive membranous vault which surrounds the early brain, and the faulty chondrification of the vertebral bow of the primitive membranous spinal column which surrounds the early spinal cord. Why should this defective formation occur? It may be due to an inherent defect of a chromosomal nature in which condition unhealthy mesodermal tissue is produced.

The authors report 11 new cases of craniolacunia in one of which the diagnosis was made before birth. The incidence rate is shown to be vastly greater than suspected in England and equals that recently demonstrated in America. DANIEL G. MORTON, M.D.

MISCELLANEOUS

Krieger, V. I.: Observations on Shute's Test for Antiproteolytic Properties of Human Blood Serum in Cases of Abortion, Premature Labor, Accidental Hemorrhage, and Normal Pregnancy. *J. Obst. Gyn. Brit. Emp.*, 1943, 50: 48.

Since 1935 Shute has published an interesting series of articles describing an antiproteolytic power exhibited by the blood serum of women in whom abortion, premature labor, accidental hemorrhage, or some of the toxemias of pregnancy occurred. This antiproteolytic power is said to be due to excess estrin in the blood and is often associated with vitamin E deficiency. Shute claimed that these accidents of pregnancy could frequently be prevented by suitable vitamin E therapy. If these claims could be substantiated a tremendous advance in the treatment of abnormal pregnancies would be achieved.

Incubation at 38° C. of the serum of pregnant women with trypsin in buffer solution at pH 8 resulted in variations of free acid during a period of forty minutes, but there was no consistency in the type of curve obtained by estimation of the free acid at regular intervals. Prolongation of the test to one hundred minutes did not affect the types of curves obtained. The results do not support claims recently made by Shute that free acid is liberated under the mentioned conditions within a period of forty minutes. In some cases there is an increase, in others a decrease, and in some there are only slight fluctuations in acidity of the incubated mixture.

The experiments show that slight variations occur without serum, and it can be definitely stated that the variations are not a tryptic effect since serum and buffer; serum, trypsin, and buffer; and serum, inactivated trypsin, and buffer, each give almost identical curves. In the author's experience serum from neither normal nor abnormal patients showed evidence of digestion by trypsin under the conditions specified.

The observations recorded in this article, together with the results of Cuthbertson and Drummond, indicate that Shute's test for the inhibition of proteolysis is not a satisfactory means of distinguishing women in whom abortion, miscarriage, premature labor, or accidental hemorrhage is likely to occur from those whose pregnancy is likely to pursue a normal course. DANIEL G. MORTON, M.D.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

McMartin, W. J., and McCurdy, T.: The Kidney in Hypertension. *J. Urol.*, Balt., 1943, 49: 524.

Hypertension as a result of disease of one kidney, while uncommon, warrants emphasis and the authors present 4 cases by way of illustration. They believe that urological examination should be done before referring the hypertensive patient for denervation operations or medical therapy and think that the eyeground changes of hypertensives will regress toward normal if the kidney creating hypertension is removed before arteriolar disease of the opposite kidney gets under way.

Among the 4 cases presented, 1 patient developed hypertension from perinephritis and perinephric adhesions following pyelolithotomy eleven years previously. His kidney was atrophic and markedly adherent to the surrounding structures. Following removal of the kidney, the patient showed marked regression of the effects of hypertension with return of the blood pressure to normal. Two other patients had severe hypertension with marked arteriolar changes in hydronephrotic kidneys. The fourth patient had slight dilatation of the pelvis and calyces with pyelonephritis and severe hypertension, but the arterioles were in an early state of obliteration. Nephrectomy was done, which effected a reduction in the blood pressure and disappearance of the symptoms.

Patients who have had previous renal surgery, such as pyelotomy, nephrotomy for stone or perinephric abscess, plastic surgery of the renal pelvis, or nephropexy should have a periodic check of their blood pressure so that the onset of hypertension may be found early and the source of the hypertension removed if it be suspected that the origin is in the kidney which had been operated upon previously.

ARTHUR H. MILBERT, M.D.

Castleman, B., and Smithwick, R. H.: The Relation of Vascular Disease to the Hypertensive State, Based on a Study of Renal Biopsies from 100 Hypertensive Patients. *J. Am. M. Ass.*, 1943, 121: 1256.

The authors report their findings on 100 renal biopsy specimens from different patients at the time of splanchnic resection for hypertension. The specimens were divided into 5 groups based upon the microscopic vascular obliteration noted in each specimen. The degree of vascular involvement varied from no involvement to the fifth group in which every vessel in the biopsy specimen was involved and a great number of the glomeruli and tubules demonstrated obliteration. It was further noted that plasma flow and renal function were progressively diminished as vascular involvement increased in the biopsy tissue.

All the patients studied presented eyegrounds with retinal vascular changes ranging from arteriolar narrowing to edema with elevation of the optic discs. The average age of the patients was thirty-nine years and the average blood pressure 210/139. The distribution of the 100 patients in the five groups was as follows: (0) 7 per cent; (1) 21 per cent; (2) 25 per cent; (3) 33 per cent; and (4) 14 per cent.

The authors recorded the fact that some 28 per cent of the specimens showed no vascular disease while 25 per cent demonstrated only mild vascular lesions. This is in sharp contrast to the picture usually found on examining necropsy specimens of hypertensives in whom vascular disease is invariably present. Hence, with this in mind the authors point out that the evidence seems to suggest that renal ischemia is not the forerunner to essential hypertension as is commonly believed.

The authors found 7 patients with adrenal tumors in this series of 100 and in 2 instances pheochromocytomas were demonstrated in spite of the fact that paroxysmal hypertension was not discernible.

ROBERT LICH, JR., M.D.

BLADDER, URETHRA, AND PENIS

Bacon, S. K.: Rupture of the Urinary Bladder. *J. Urol.*, Balt., 1943, 49: 432.

The increased incidence of rupture of the urinary bladder and the high attendant mortality rate led the author to a careful analysis of 147 instances treated at the Los Angeles County General Hospital during the ten-year period from June, 1932, to June, 1942. All cases of rupture or perforation with the exception of those associated with general, gynecological, and obstetrical surgery were included.

Causative factors fell into three main groups: external trauma, 102; transurethral instrumentation, 40; and spontaneous rupture, 5. Of the external traumatic agents, moving vehicles accounted for 73, falls were responsible for 11, gunshot for 9, kicks or blows for 7, stab wound for 1, and sitting on a sharp object for 1. Twenty-nine, or 28.5 per cent of the patients were intoxicated or had been drinking.

Of the bladder ruptures due to transurethral instrumentation, 23 were incident to transurethral prostatectomy. During the ten-year-period, 1,629 such operations were performed and the incidence of the accident was 1.4 per cent. It is further emphasized that the accident occurred in the early days of resection in the majority of the cases. Catheterization preceded 7 instances of rupture of the bladder, while cystoscopy accounted for 4, fulguration or biopsy of the bladder for 4, and litholapaxy and Pezzar catheter introduction for 1 each. Spontaneous rupture occurred in 5 patients, 4 of whom had carcinoma and the fifth with no history or physical finding of trauma or instrumentation.

The youngest patient was five years of age, while the oldest was eighty-nine. In the six decades between the ages of ten and seventy, the average number of cases was roughly 20 in each decade. Thus, only 3 instances occurred in children under ten and fourteen in patients over seventy-one years of age. The sex incidence was 90 males (23 during transurethral prostatic resection) and 57 females.

The predominating symptoms and findings were pain, shock, hematuria, retention of urine, and skeletal injuries. Diagnosis was established by history of the injury, symptoms, physical findings, roentgenographic evidence including cystography, surgical exploration, and occasionally autopsy. The author states that cystography was the most important single diagnostic procedure.

Rupture was extraperitoneal in 90, or 61.2 per cent, and intraperitoneal in 57, or 38.8 per cent of the cases. Two patients presented simultaneous lesions in both locations. In the group of 102 cases due to external trauma, 72 patients sustained fractures of the pelvis and 75 per cent manifested concomitant extraperitoneal rupture of the bladder. The pelvis was not fractured in 30 cases and 76.6 per cent of these cases showed intraperitoneal ruptures.

Surgery was carried out in 126 of the 147 patients. Of the remaining 21, 19 died. Suprapubic cystostomy was the operation of choice in 64, suprapubic cystostomy and repair in 49, vesical repair and indwelling catheter in 11 (4 of these died), and drainage of the prevesical space and indwelling catheter in 2. The surgical mortality was 36.5 per cent and included 46 postoperative deaths. Adding the 19 deaths in the group of 21 unoperated patients, the total mortality was 65, or 44.2 per cent in 147 cases.

The time from injury to surgery averaged nineteen and eight-tenths hours. The shortest interval was two hours and the longest one hundred and ninety-two hours; in the last case the patient died. The average time from admission to surgery was eleven and three-tenths hours. This relatively long average was attributed to delay influenced by admission of the majority of the traumatized patients to the orthopedic, neurosurgical, or general surgical service.

In dealing with rupture of the urinary bladder, the most important considerations are treatment for shock, early diagnosis, prompt surgical exploration, and suprapubic drainage. The ideal management is one of immediate action: external heat, blood grouping, intravenous solutions, physical examination, plain roentgenograms of the area from ribs to pelvis, catheterization, contrast cystograms, and surgery. Cystoscopy is generally a superfluous manipulative measure and adds to the already existing trauma. Exploration of the peritoneal cavity for evidence of injury to other viscera through a small incision in the peritoneum is a rational procedure.

The mortality rate in this series of ruptures of the urinary bladder plainly illustrates the seriousness of the injury. Associated pathology, such as multiple fractures, traumatized intraperitoneal viscera, and shock, were factors which greatly influenced the end-result. Failure to recognize the lesion promptly, and in a few instances overlooking it entirely, increased the mortality. ARTHUR H. MILBERT, M.D.

Abeshouse, B. S., and Goldstein, A. E.: Primary Carcinoma in a Diverticulum of the Bladder; A Report of 4 Cases and a Review of the Literature. *J. Urol.*, Balt., 1943, 49: 534.

The occurrence of carcinoma and diverticulum of the bladder, independently or simultaneously, is relatively common but primary carcinoma in a diverticulum is a relatively rare finding. The authors believed that a review of the literature was justified to supplement personal data obtained from 4 of their own cases. Ninety-one cases of primary malignant neoplasm in a diverticulum were found, and the addition of their own 4 cases brings the total up to 95.

Although rare, the condition occurs more frequently than the literature indicates. It is primarily a disease of males, the ratio being 27 males to 1 female. Age predilection fell between fifty and sixty-five years. Pathologically, every effort was made to differentiate between primary neoplasms of a diverticulum and those arising in the bladder and extending into the diverticulum. All doubtful cases were omitted from the present series. The primary neoplasm within a diverticulum may be benign or malignant and closely simulates those arising in the bladder. The most common type observed was carcinoma of epithelial origin, either squamous-cell epithelium or papillary carcinoma.

No definite syndrome characterizes the condition. The most common and important symptom is hematuria. Other frequently noted symptoms are those associated with infection of the bladder and diverticulum or obstruction of the vesical neck: diurnal frequency, nocturia, urgency, dysuria, and pain on urination. Symptoms of malignancy such as cachexia and anemia may be noted in advanced cases.

Because of varied symptomatology, diagnosis may be difficult, and because of the patient's procrastination, the condition is often seen in a late stage in the course of the disease. The most important aids in diagnosis are cystoscopy and cystography. When a portion of the tumor protrudes through the orifice of the diverticulum and can be seen cystoscopically, the diagnosis is easy. Occasionally, the cystoscope may be introduced into the diverticulum and the neoplasm visualized. Bleeding from the orifice of the diverticulum is strongly suggestive of a tumor. Likewise, a filling defect in diverticulography is strongly indicative of a tumor.

The authors believe that every diverticulum observed at operation regardless of cause should be carefully exposed and inspected and in all suspicious cases it should be removed. Infection and calculus formation may accompany the condition as well as other associated urinary-tract lesions.

Surgical treatment has been far from satisfactory but yields better results from the standpoint of symptomatic relief and cure than nonoperative treatment. The operation of choice is excision of the

diverticulum and tumor by the suprapubic intravesical or extravesical method, or a combination of both. Patients with extensive local or general metastases or severe infection of the urinary tract, and poor surgical risks should not be subjected to radical operative treatment.

The outlook for the patient with primary malignant disease of a diverticulum is decidedly poor as indicated by the results reported in the early and recent literature. Relatively few cures have been reported and the majority of patients succumb within two years following operation. The untreated patient or the patient treated by palliative nonoperative or conservative operative procedure has little to look forward to except a slow, lingering but painful existence.

An extensive bibliography includes the reference source of each case cited from the literature.

ARTHUR H. MILBERT, M.D.

GENITAL ORGANS

Benjamin, J. A., Robertson, T. D., and Cheetham, J. G.: Vasitis Nodosa. A New Clinical Entity Simulating Tuberculosis of the Vas Deferens. *J. Urol.*, Balt., 1943, 49: 575.

The authors have recently had an opportunity to study a case of nontuberculous beading of the vasa that presented findings which were unlike any observed in a thorough search of the literature and in a careful study of stained sections of many normal and pathological vasa. Since nontuberculous beading of the vas has not as yet been classified as to cause it seemed advisable to present the following case report along with its pathological findings with the hope of stimulating studies of this subject.

In order that they might explain their findings they considered 4 possible causative factors: namely, faulty development, infection, diverticula, and cyst formation.

Faulty development. The faulty development of the caudal or posterior group of mesonephric tubules contributes interesting speculative data. In man about 15 of these tubules fail to be incorporated into the epididymis proper and persist as paradidymal ducts and vasa aberrantia.

Burns gave some pertinent observations which tend to substantiate the association of the authors findings with faulty development of the caudal group of mesonephric tubules: "I am familiar with their appearance in laboratory animals, especially in the opossum, in which they appear in variable numbers and in a variety of forms. Some resemble the structures in your pictures almost to identity; others are dilated and cyst-like; others are slender, tortuous canals which may be connected to the vas or isolated. Likewise any of these types may lie near the lumen of the vas, or at considerable distances. Typically they show a low columnar or a flat cuboidal type of epithelium."

Infection. Since the pathological report stated the presence of a perivasitis and inflammatory reaction

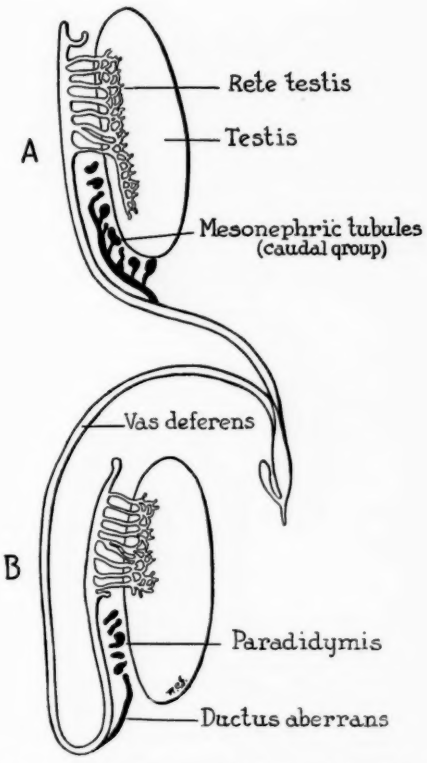

Fig. 1. *a*, Shows diagrammatically the relation of the vas deferens to the caudal group of mesonephric tubules. (Undescended testis.) *b*, Shows the relation of the vas deferens to the vestigal structures derived from the caudal group of mesonephric tubules. (Descended testis.) (Modified after Kiebel and Mall, permission of J. B. Lippincott Co.)

in the vasal wall itself, the role of infection could not be disregarded in the authors' case. Furthermore, the patient had a chronic prostatoseminal vesiculitis. Staphylococcus albus was grown from the cultured prostatic secretion. It is of interest to recall that Wolbarst pointed out that the vas might be infected when there was no apparent infection of either the epididymis or seminal vesicles.

Diverticula. During the study of the vasal pathology one of the authors (T. D. R.) suggested that the findings in the vas deferens might be compared to those of Schenken in the fallopian tubes.

If the authors' pathological findings are compared with those of Schenken then the symptoms of our patient may partly be explained on the basis of a communication of the vasal lumen with some of the epithelial-lined spaces. This would permit the spermatozoa to accumulate in these spaces after

intercourse and this could explain the pain, pressure, and swelling in the vas after coitus. Moreover, the patient had pain, pressure, and swelling in the cord at other times, and this might be explained on the basis of the works of Oslund, Wilhelm, and others, who gave evidence favoring a constant flow of spermatozoa via the vasa deferentia into the posterior urethra.

Cyst formation. One might also compare these epithelial-lined spaces to small cysts, on the basis of the histology in the stained section. In some instances cysts are thought to be congenital. For example, Emmerich described solitary cysts in the left vasa without spermatozoa which he thought might be associated with embryonal maldevelopment because, in his case, the right kidney and ureter were completely lacking. However, Menzies and Falk showed that if the kidney and ureters were absent it did not necessarily follow that the vasa and seminal vesicle need be absent; this has been the finding in some cases. JOHN A. LOEF, M.D.

MISCELLANEOUS

Neurath, H., Dees, J. E., and Fox, H.: The Preparation and Properties of Human Fibrinogen Solutions. *J. Urol.*, Balt., 1943, 49: 497.

The authors discuss a method of preparation of fibrinogen for the purpose of producing a clot of adequate tensile strength so as to be useful in the new operative procedure for the removal of small renal calculi and calculous fragments. The fundamental principle of this procedure is that a fluid is introduced into the renal pelvis and this clots and enmeshes the renal calculi so that when the clot is removed the calculi are withdrawn.

Fibrinogen constitutes approximately 0.4 per cent of human plasma and is one of the three main constituents of plasma. The properties of this substance resemble those of euglobulin and it is slowly denatured at room temperature.

The tensile strength of the fibrinogen clot is measured by producing a clot within a glass tube which has a piece of gauze enmeshed at each end. This clot is then suspended and to its lower pole a cup is attached which is filled with water from a pipette, and when the clot breaks its tensile strength is computed from the amount of water in the cup plus the weight of the cup.

Fibrinogen is prepared by its precipitation from plasma through the addition of saturated ammonium sulfate to the point of 25 per cent saturation at 0° C. after the plasma has been adjusted to a pH of 7.6. The resultant precipitate is separated and thrice dialyzed against saline solution to remove the ammonium sulfate. During dialysis the fibrinogen goes into solution and the pH is checked to a pH 7. The fibrinogen following filtration through a Seitz filter is sealed in sterile containers and stored in the frozen or frozen dried state.

The tensile strength and yield of fibrinogen were found to be greatest when the concentration of ammonium sulfate used for precipitation was 25 per cent. The pH 7.0 was demonstrated as the most favorable hydrogen ion concentration for maximum tensile strength. Seitz filtration was found to increase the tensile strength of the clot on an average of 20 gm., but the reason for this was not evident. ROBERT LICH, JR., M.D.

Ailen, F. M.: The Experimental Production of Various Renal Vascular Disorders. *J. Urol.*, Balt., 1943, 49: 512.

Intermittent clamping or ligation of the renal vessels in imitation of arterial spasms produces certain phenomena in dogs: uremia with an apparent functional element, acute and chronic hypertension, and possibly susceptibility to attacks resembling epilepsy. A similar procedure in the author's hands applied to the pancreas produces diabetes.

Points of theoretical interest in connection with each manifestation are discussed and emphasis is placed on the importance of the delicate regulation of the circulation in all of the organs, the known frequent occurrence of general and local spasms, and the extensive but poorly understood consequences of disturbances in this domain.

The production of the four types of derangements described suggests a still wider range of disease entities. ARTHUR H. MILBERT, M.D.

Fox, C. L., Jr., Jensen, O. J., Jr., and Mudge, H. G.: The Prevention of Renal Obstruction during Sulfadiazine Therapy. *J. Am. M. Ass.*, 1943, 121: 1147.

Renal obstruction during therapy with sulfapyridine, sulfathiazole, and sulfadiazine has been the subject of numerous reports in recent literature. With the exception of sulfanilamide, which is a relatively soluble drug, the sulfonamides are relatively insoluble and lead to renal complications, usually of an obstructive nature. The authors undertook to show that if the solubility of these drugs could be increased, this complication might be prevented.

Starting with a determination of the solubility of sulfathiazole and sulfadiazine, and their acetyl derivatives in normal human urine over the pH range of 5.0 to 8.0, the authors noted a decided increase in the solubility of these substances as the urine was made more alkaline. With this as a basis, maintenance of a consistently alkaline urine was tried as a means of preventing renal obstruction during sulfadiazine therapy.

Two patients with subacute bacterial endocarditis were given massive doses of sulfadiazine, and with certain exceptions their urine was maintained consistently alkaline with large doses of bicarbonate. In each instance, after preliminary alkalinization of the urine, 25 and 30 gm. of sodium sulfadiazine were given intravenously in 500 and 600 cc. of distilled water, respectively. From 10 to 20 gm. of sodium or potassium bicarbonate were given daily. As a result, high concentrations of sulfadiazine were held in solution in alkaline urine, oliguria and renal obstruction

were prevented, and crystalluria occurred in those urine specimens in which the pH fell below the in vitro solubility limits.

The quantity of bicarbonate to be given should be judged by the pH of the urine. To maintain sulfadiazine in solution during full therapeutic dosage, a pH of 7.5 or higher is essential. When alkaline urine with high concentrations of sulfadiazine in solution is voided, decreasing the pH slightly will immediately precipitate the drug. In renal lavage therapy, directed at flushing the pelves and ureters of obstructing sulfonamide compounds, alkaline bicarbonate or carbonate solutions are recommended since these will dissolve drug crystals much better than warm water or isotonic saline solution. Utilization of this information in routine therapy with sulfathiazole and sulfadiazine in average doses would remove the hazard of their renal complications.

ARTHUR H. MILBERT, M.D.

Carlson, H. E.: Five Per Cent Saline Enemas in Urological Practice. *South. M. J.*, 1943, 36: 328.

The author discusses the value of various enemas in reference to their effectiveness in producing intestinal activity of the small gut. Dogs were used in which tracings of the jejunum were taken from Thiry-Vella jejunal loops and checked by tracings from Ivy-Mann fistulas, while the ilial activity was observed by tracings from ileostomies. It was found that enemas with hypertonic saline solution alone produced an accelerated peristalsis of the small intestine. Since saline solutions of 10 per cent or more caused proctitis in dogs and man it was found advisable to keep the enema solution at 5 per cent to avoid this complication.

A simple way to mix a 5 per cent saline solution is to add a level medicine glassful of common salt to 1,000 cc. of water. The mechanism of enhanced intestinal activity was considered to be due to salt absorption through the gut wall which increased the blood content and in turn stimulated the activity of the small bowel. This was proved by the intravenous administration of hypertonic saline solution.

The article is illustrated by several tracings of intestinal activity following various enemas in experimental animals and also by several roentgenograms demonstrating the value of the hypertonic saline enema one hour preceding intravenous urography. The author also calls attention to the usefulness of the hypertonic enema after operation to restore chemical balance in the body and combat abdominal distention. ROBERT LICH, JR., M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Pérez, I. P.: A Study of the Treatment of Hematogenous Osteomyelitis; Review of 300 Cases (Estudio crítico sobre el tratamiento de la osteomielitis hematógena. Revision de 300 casos). *Cir. ortop. traumat.*, Habana, 1942, 10: 81.

The author reviews 300 cases of hematogenous osteomyelitis which he saw and treated in the orthopedic section of the Medical School of Havana. He has not included cases caused by compound fractures or operations on the bones. Generally this disease occurs in childhood and adolescence, although there were 11 cases in this series that were primary in adults. The disease affects the lower limbs more frequently than the upper. In this series 81 per cent of the cases were in the lower limbs, 17.34 per cent in the upper limbs, and 1.66 per cent in the bones of the trunk. In 110 of the cases the patients had suffered some injury in the region where the osteomyelitis appeared later, the time between the injury and the beginning of the disease varying from three to twenty-four days. Within the preceding twenty-five days some of the patients had had furunculosis, pneumonia, typhoid, measles, tonsillitis, bronchitis, pyelitis, acne, eczema, pyodermitis, apical abscess, chickenpox, or vaginal discharge. About two-thirds of the cases were in males and one-third in females. In the great majority of the cases (91 per cent) the causative micro-organism was the staphylococcus. The form of the disease was hypertoxic in 2.66 per cent, acute in 43.00 per cent, chronic in 48.66 per cent, Garré's sclerotic form in 3 per cent, and Brodie's abscess in 2.66 per cent.

The treatment of the disease varies according to the virulence of the bacteria and the defensive capacity of the patient. In the hypertoxic and acute forms the former is high and the latter low and in the other forms the reverse is true. In the hypertoxic form treatment is directed toward increasing the defenses of the patient with vaccines and destroying the bacteria with drugs. The method of preparing a staphylococcus vaccine for these cases is described. In the acute form when the patient's condition permits, the marrow cavity is opened up freely, the cavity curetted and packed with vaselinized gauze, and the limb is immobilized. Resection of the diaphysis has been recommended, but the author finds that this involves danger of pseudarthrosis and deformity. Illustrative roentgenograms are given. Orr's method of opening up, curetting, and packing the marrow cavity is used in chronic cases. Various modifications of the method are discussed as well as the treatment with maggots.

The development of the sulfa drugs has brought about a great change in the treatment of hematogenous osteomyelitis. While these drugs have proved very effective they do not obviate the necessity for surgical opening of bone abscesses in many cases. Experiments on rabbits relating to the prophylactic and curative effects of these drugs are described.

Among the author's 300 cases cure was brought about in 81.66 per cent—without shortening or impairment of function in 29.66 per cent, while in 52 per cent there is some thickening of the bone, shortening and impairment of function; 2.66 per cent of the cases are still in process of development, and the final results are not yet known in 11.66 per cent. Amputation was necessary in 8 cases, or 2.66 per cent, and 4 patients (1.33 per cent) died. Among the 8 cases of amputation there were 3 in which the disease had persisted for thirty years and malignant tumors had developed at the site of the osteomyelitis. Two of these tumors were carcinomas and 1 was an osteosarcoma. Two of the patients died in a short time and the other was lost. In a fourth case a malignant tumor had developed at the site of the osteomyelitis. The patient in this case left the hospital when amputation was proposed.

AUDREY G. MORGAN, M.D.

Follis, R. H., Jr., and Jackson, D. A.: Renal Osteomalacia and Osteitis Fibrosa in Adults. *Bull. Johns Hopkins Hosp.*, 1943, 72: 232.

That there is a close relationship between renal disease, osseous changes, and parathyroid hyperfunction seems fairly well established both from experiments in animals and from clinical and anatomical studies in human beings. Although the exact mechanism for such a relationship has not been fully elucidated, cases of "renal rickets" or "renal osteitis fibrosa" make it clear that bone lesions may develop in the course of prolonged renal insufficiency. Whether such changes are due to hyperparathyroidism, acidosis, increased alimentary phosphate excretion, or other unknown factors are controversial points.

A few reports would seem to indicate that one can recognize histological alterations in the skeletal system in cases of renal insufficiency in adults before they manifest themselves clinically or by roentgen-ray examination. The present study was undertaken to determine the nature and the extent of such lesions in a series of routine autopsies on patients dying of chronic nephritis, and to correlate, if possible, the pathological and clinical pictures.

Sections of the vertebrae were studied in 39 adults dying of renal insufficiency. In addition the bones of 14 persons dying of some acute surgical emergency (e.g., fractured skull) were examined as controls. The authors also examined 4 cases of "renal rickets" and 1 other unreported case.

The histological method used consisted in partial decalcification in nitric acid, imbedding in celloidin, and staining with hematoxylin and eosin. The

authors compared this method with that in which no decalcification is carried out, as recommended by McLean and Bloom, and found the two to agree.

On the basis of our present knowledge, it would seem unwise to attempt to explain the skeletal changes observed. The problem is far too complex. Many variable factors are concerned. The blood serum protein, calcium, and phosphorus, the degree of acidosis, the intake and excretion of calcium, the influence of parathyroid hormone normally and under the influence of renal insufficiency, must be taken into account. Until pointed experiments are performed on animals, the exact role of each in cases of renal insufficiency such as those we have studied will not be known.

When one considers the high incidence of lesions in the glomerulonephritic group, and the relatively low incidence in the cases of vascular nephritis, it is probable that the duration of the disease is the decisive factor. In the latter group, severe renal insufficiency is usually present for a shorter time than in the former even though long-standing hypertension and some evidence of renal damage have been present for many years.

In this study no detailed examination of the parathyroid glands was made. Such an investigation entails finding and weighing all these organs at autopsy. This has not been performed routinely.

In a study of routine autopsies in cases of renal insufficiency of various types, histological changes were found in the vertebrae in half. The most prominent finding was the presence of excessive osteoid tissue so that a diagnosis of osteomalacia was justified. In a lesser proportion the changes of osteitis fibrosa were encountered.

Skeletal lesions were found more often in cases of chronic glomerulonephritis or pyelonephritis than of chronic vascular nephritis.

ROBERT T. MCELVENNY, M.D.

Hermeto, S., Jr.: A Form of Engel-Recklinghausen Disease Affecting Only One Bone. Parathyroidectomy (Forma monoostótica da moléstia de Engel-Recklinghausen. Paratireoidectomia). *Rev. brasil. ortop. traumat.*, 1942, 3: 169.

The parathyroid hormone influences calcium and phosphorus metabolism. Engel-Recklinghausen disease is characterized by cysts in the bones caused by decalcification due to hypersecretion of parathyroid hormone. The disease may be revealed by pathological fractures resulting from the cysts or by laboratory examinations showing the characteristic picture of hyperparathyroidism.

The author describes a case in a young man of twenty in whom there was a cyst only in one bone—the left humerus—although roentgenograms showed decalcification in the other long bones and the bones of the feet. The young man had been in good health with no bone symptoms until he fell on his left arm, after which he had pain in the arm and a sensation of its having gone to sleep. The first roentgenogram taken about a month after the accident showed a large cyst occupying the upper metaphysis and the diaphysis of the humerus with a recent fracture in the upper part of the cyst. It was divided into two parts, a small lower one and a large upper one, by a bridge of bone. Laboratory examinations showed the blood calcium to be 17 mgm. per cent, the blood phosphorus 4.91 mgm. per cent and the blood phosphatase 6.17 Bodansky units. As this suggested parathyroidism, a careful search was made for a parathyroid adenoma but none was found. However, a very small tumor about the size of a grain of millet seed was found on the lower third of the posterior surface of the left lobe of the thyroid. This was removed and histological examination showed that it was made up of normal parathyroid and thymus tissue.

Roentgen examination a month after operation showed a calcium deposit filling in the cyst and laboratory examinations showed the blood calcium to be 9.8 mgm. per cent, the phosphorus 5.9 mgm. per cent and the phosphatase 2.9 Bodansky units. Another examination six months later showed ossification in the former cyst, complete disappearance of the old fracture and thickening of the cortex of the other long bones which had shown decalcification. The blood calcium was 11.3 mgm. per cent, the phosphorus 5.4 mgm. per cent and the phosphatase 5.58 Bodansky units. The patient's general condition was excellent, the function of the arm normal, and he was doing work that required considerable physical exertion.

Roentgenograms of the bones and microphotographs of the tumor are given.

AUDREY G. MORGAN, M.D.

Leavitt, D. G.: Subastragaloid Arthrodesis for the Os Calcis Type of Flatfoot. *Am. J. Surg.*, 1943, 59: 501.

The results from surgery in patients with the os calcis type of flatfoot have been the most uniformly satisfactory series of surgical results in flatfeet experienced to date by the author. In practically every case the result has been good or excellent. A few patients have some minor disturbances of the feet, but no serious return of deformity, while some of the feet have an entirely normal appearance and an apparently normal function.

The os-calcis type of flatfoot may be defined as a postural deformity of the foot in which apparently valgus or eversion of the rear of the foot occurs and is responsible for the subsequent deformities associated with depression of the longitudinal arch. Functional deformity of the os-calcis type of flatfoot without abnormal congenital protrusion or deformity of the head of the astragalus and especially of the scaphoid can be prevented by subtalar arthrodesis. Symptoms of decompensation or foot strain accompanying this type of flatfoot can best, most satisfactorily, and permanently be corrected by subtalar arthrodesis. It is sometimes necessary to remove the abnormal prominence of the scaphoid bone.

ROBERT P. MONTGOMERY, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Girdlestone, G. R.: Acute Pyogenic Arthritis of the Hip. An Operation Giving Free Access and Effective Drainage. *Lancet*, Lond., 1943, 244: 419.

Proper surgical drainage of the hip joint for acute pyogenic arthritis is necessary after conservative measures such as immobilization, daily aspiration, and the chemotherapy of sulfonamides and penicillin fail. Acute pyogenic arthritis may be hematogenous in origin or may be due to a gunshot wound or compound fracture, and may be classified into two groups Group A cases are those cases in which ankylosis of the hip joint has not yet occurred and suppuration may be in various stages of extension. Group B cases are those in which ankylosis is present, pus has burrowed into the intermuscular planes, and/or sinus tracts are present.

The operation recommended by the author is done in the following manner. A transverse incision is made 1 in. behind and below the anterior superior spine and extended backward with the center 1 in.

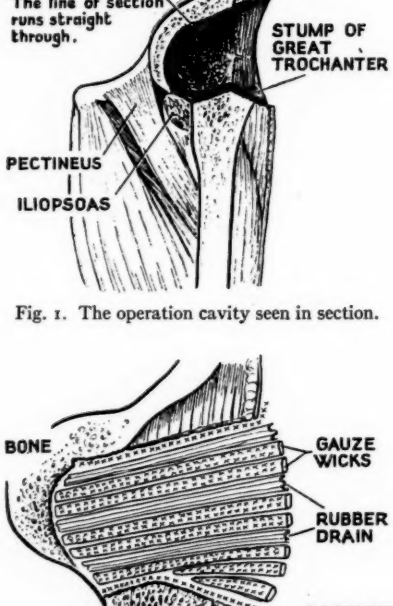
The cut edge whence upper rim of acetabulum has been removed
The line of section runs straight through.
STUMP OF GREAT TROCHANTER
PECTINEUS
ILIOPSOAS

Fig. 1. The operation cavity seen in section.

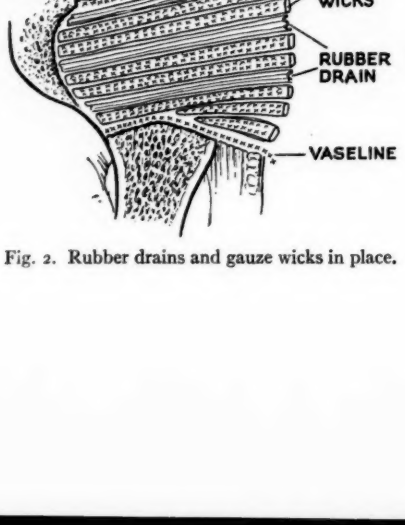

Fig. 2. Rubber drains and gauze wicks in place.

above the great trochanter. A wide ellipse of gluteal fascia is exposed. The gluteal muscles are divided down to the ilium just above the acetabulum. A second lower incision through the gluteal fascia exposes the base of the greater trochanter. The trochanter and its attached tissue are removed en masse in an upward direction so that the glutei are included. The capsule, synovia, neck, head, and acetabular rim of the hip joint are removed and all necrotic bone and cartilage curetted. The presence of an intrapelvic abscess requires the removal of the acetabular floor and as much of the neighboring ilium as will provide free drainage. After such excision, the upper and lower flaps of skin are drawn down into the wound and sutured except when there is extensive suppuration. Under certain conditions, in cases with sinus tracts which extend to the mesial aspect of the joint and involve the small trochanter, additional drainage may be obtained by excision of the pectineus and the adductor muscles through a medial incision. Neurovascular structures such as the femoral nerve, the sciatic nerve, and the femoral blood vessels are not damaged by this technique. Hemorrhage of other small vessels is treated by ligation under direct vision. The sides of the wound are lined with vaseline gauze and rubber and gauze drains are inserted. Immobilization is necessary, and upward displacement of the femur is prevented by the use of the double hip frame, a plaster spica with window and bridge, or fixed traction on a Hodgen splint.

Dramatic relief from toxemia and pain is obtained in patients treated in this manner. The wounds heal within a few months with a firm scar and a stable joint. This is another radical extension of the Orr treatment and is worthy of trial in suitable cases.

BENJAMIN G. P. SHAFIROFF, M.D.

Blount, W. P.: Blade-Plate Internal Fixation for High Femoral Osteotomies. *J. Bone Surg.*, 1943, 25: 319.

Plaster-cast immobilization after high femoral osteotomy can be eliminated by internal fixation with a blade-plate. Accurate control of position and firm fixation at the site of osteotomy are combined with early motion of the hip. The patient may walk with crutches in two weeks and without them in from eight to ten weeks.

The stainless-steel fixation device consists simply of a flat blade for insertion into the trochanter and femoral neck and a flat plate to be screwed to the femoral shaft. The blade-plate may be easily modified as to size, shape, and angulation to permit adaptation to a variety of purposes and situations. It has been used successfully in trochanteric and subtrochanteric fractures, for ununited fracture of the femoral neck, congenital dislocation of the hip, shortening of the femur, coxa plana, coxa vara, and for the correction and mobilization of vicious ankylosis.

The upper shaft and trochanter of the femur are exposed through a lateral incision. For high femoral

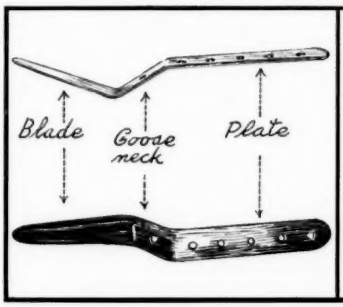

Fig. 1.

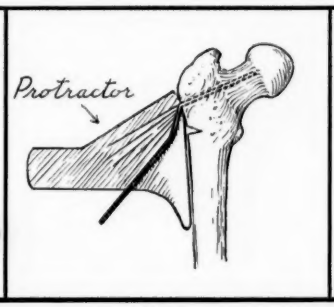

Fig. 2.

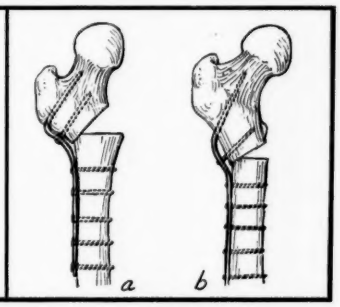

Fig. 3.

Fig. 1. The standard double-angle blade-plate.
Fig. 2. The angle of the insertion of the blade and the angle of the osteotomy are measured with a protractor.

Fig. 3. (a) High osteotomy completed. (b) Low osteotomy completed. (Courtesy of Modern Medicine.)

osteotomy, a double angled blade-plate is used (Fig. 1). A guide pin is inserted into the trochanter and neck, and a drill at the site of the osteotomy. The levels are checked by anteroposterior and lateral roentgenograms. The lateral third of the osteotomy is completed ½ in. below the entrance of the blade. The blade is started through a suitable hole in the cortex and driven into the trochanter and neck, at times into the head. The angle between the plate and the shaft of the femur which is accurately determined by a special protractor (Fig. 2), can be modified as desired before operation or at this point. A screw is inserted through the gooseneck into the proximal fragment and then the osteotomy is completed. While the lower fragment is abducted, the plate is clamped to the bone and screwed securely in position (Fig. 3). After check-up x-rays the wound is closed. No external fixation is necessary. Photographs and roentgenograms illustrate the method.

FRACTURES AND DISLOCATIONS

Watson-Jones, R., and Coltart, W. D.: Slow Union of Fractures, with a Study of 804 Fractures of the Shafts of the Tibia and Femur. *Brit. J. Surg.*, 1943, 30: 260.

The test of success in the treatment of a fracture is the quality of end-result rather than the time taken in achieving this result. It is better that a fracture should unite soundly and without disability in four months, than that it should unite imperfectly and with deformity in two months. Time is not saved when recovery is accelerated at the cost of permanent disability; a disabled man loses time every day of his life. Although prevention of permanent disability must be the first consideration, prevention of unduly prolonged disability must be the second. As a broad generalization it may be estimated that the duration of total disability is half as long again as the time taken for union of the fracture. It is doubly important, therefore, to prevent unnecessary delay in the union of a fracture, and equally important to investigate the recent challenge that modern methods of fracture treatment are responsible for serious delay. The impression that fractures of the shafts of the femur and tibia are uniting more slowly than in former years has gained wide acceptance. The surgical literature of the last thirty years appears to give undoubted support to this impression.

Uncomplicated fractures treated by simple manipulation and plaster are uniting as quickly today as in former years. Fractures of the tibia were never soundly united in six or seven weeks; they were only 'clinically united', and late yielding, malunion, or nonunion often occurred. Before accepting the charge that recent methods of treatment have doubled or trebled the time of union, two great changes in the principles of fracture treatment must be examined, changes which distinguish the practice of today from that of thirty years ago: (1) the present tendency to demand evidence of roentgenographic consolidation rather than clinical union alone; and (2) the present belief that all fractures unite if they are immobilized long enough, and that nonunion is never inevitable.

In former years it was customary to remove splints at the earliest possible moment, usually at the first sign of clinical union; today, protection in plaster is continued until the patient is able to walk, run, and play games, and often until there is roentgenographic evidence of consolidation. 'Clinical union' as shown by disappearance of local tenderness, freedom from elasticity, springing of the fragments is often reached within six or eight weeks of injury; "roentgenographic consolidation" as proved by uniform calcification of the callus is not completed until many weeks later. This is true today and it was true in former years. We must not compare the time required for early clinical union thirty years ago with the time required for roentgenographic consolidation today.

Protection of recently formed callus is no longer discontinued after six or eight weeks, but only after

ten or twelve weeks, not because fractures are uniting more slowly, but because immobilization is deliberately continued until a later stage of union. In consequence of this more lengthy protection, the complications of malunion and nonunion which were so common thirty years ago have virtually disappeared. Moreover, final recovery has been accelerated. There can be little doubt that patients whose plasters are retained a few weeks longer than is strictly necessary for union, and who are taught to walk, run, and play football or cricket before the plaster is removed, regain confidence and overcome disuse changes more rapidly than patients who lose their protection at an earlier date.

Nonunion is not inevitable: The second recent advance in fracture treatment which has led to confusion, is the recognition that nonunion is never inevitable, and that every fracture will unite if it is immobilized long enough. We must, of course, recognize the exception of many pathological fractures and other fractures in which there is no ossifiable medium between the fragments, for example, fractures with interposition of living soft tissue between the bone ends, and fractures in which early removal of the whole thickness of the shaft of the bone causes collapse of the periosteal tube with obliteration of the fracture hematoma. If in these fractures an ossifiable medium is restored between the fragments, it is then true to say that every fracture will unite if it is immobilized long enough.

In former years a certain number of weeks was fixed as the time required for union of a fracture, and splints were removed at that date regardless of the stage of repair which had been reached; if the fracture failed to unite, nonunion was believed to have been inevitable. It is now recognized that the rate of union of a fracture is influenced by so many factors, and that so many combinations of delaying influences are possible, that no fixed time for union can be laid down. From ten to twelve weeks should be accepted as the minimal period of immobilization fractures of the lower limb shaft. Lengthy protection is not only more safe, but accelerates functional recovery. Only the minimal period of immobilization can be fixed; the average period is meaningless because there is such wide variation between uncomplicated fractures which unite in about twelve weeks, difficult fractures which unite in from twelve to twenty-four weeks, infected and distracted fractures which unite in from six to twelve months, and avascular fractures, such as fractures of the neck of the femur which unite in one to three years. It is meaningless to compare these figures with the figures of thirty years ago which averaged only the more rapidly uniting fractures. The principle of uninterrupted and prolonged immobilization, far from being assailed by such comparison, is simply shown to have been responsible for almost complete disappearance of the nonunion which was formerly accepted.

Interrupted immobilization, traction and distraction, infection, persistent angulation, too early weight-bearing, and loss of blood-supply to the fragments cause delayed union; but only when there is failure to prolong the period of immobilization accordingly do they cause nonunion. Every fracture unites if it is immobilized long enough. If a fracture is deliberately remanipulated several weeks after injury, cellular tissue between the bone ends is torn, blood vessels are ruptured, callus is refractured, and the process of repair must begin again. This is generally recognized and loss of time is accepted as the inevitable cost of correcting early failures of treatment. However, it is not always recognized that careless handling of a fracture at a time when it is being replastered may cause strain which amounts to remanipulation or refracture, and that this is no less certain in its delaying influence than a deliberate and necessary remanipulation. Distraction causes delay which persists long after the distraction is corrected. It is not a mechanical problem of bridging a gap; it is a physiological interference; distraction appears to alter the quality of repair and promote fibrous tissue rather than osseous growth.

The greater use of skeletal traction accounts for recent increase in the frequency of slow union, particularly in fractures of the shaft of the tibia. The time required for union is trebled, or more than trebled, by distraction, even if it amounts only to ¼ inch and even if it is corrected within a few days. Traction without obvious distraction also causes delay in fractures of the tibia, this form of treatment shows "an advance in the wrong direction."

In skilled hands operative reduction does not cause delay, and it is better to prevent redisplacement of unstable fractures of the tibia by internal fixation than by continuous traction. The decision to use internal fixation should be made within a day or two of injury; it should not be a last resort.

Early weightbearing in plaster, in skeletal transfixation apparatus, or in caliper splint, does not accelerate union; it delays it. The delay is most striking if angulation of the fragments is imperfectly corrected, because weightbearing then causes distraction on one side of the fracture. Weightbearing before the stage of clinical union is unwise. Functional activity, muscle development, and normal circulation can be promoted no less effectively by nonweightbearing exercise. Early weightbearing is to be discouraged; the gain is doubtful, the danger is real.

Reduction of fractures of the shaft of the femur should be secured immediately by manipulation and not gradually by heavy traction; light continuous traction should then be used only to maintain length and not also to control alinement. The fragments are manipulated as soon as possible into apposition, alinement is corrected, fixation is secured by local splintage, the weight is adjusted, the fragments are impacted, and, before the surgeon leaves the bedside, reduction of the fracture is complete. The after-treatment then consists in main-

taining reduction continuously and without interruption, splints being relied upon to prevent angulation and a weight of about 15 lb. to prevent overriding.

The time of immobilization of fracture of the femur should not be influenced by the fear of knee-joint stiffness. Permanent stiffness is due not so much to prolonged immobilization of the joint as to anchorage of the quadriceps by the initial muscle injury, subsequent infection, or low-grade infection of pin tracks.

Infection of fractures and of neighboring soft tissues causes serious delay and should be minimized by early wound excision, early sequestrectomy, and early replacement of destroyed skin by grafting. Infection of a fracture should not be a cause of nonunion. Infection is not a cause of nonunion; it is a cause only of delayed union. An infected fracture is exactly like a simple fracture except that every stage of repair is prolonged. Bone is destroyed not only by injury but also by infection; bone is decalcified not only by traumatic hyperemia but also by infective hyperemia; in the infected fracture a gap may have to be bridged. Moreover, infective hyperemia may persist for many months, and not until it has subsided can recalcification begin. Throughout this stage, granulation tissue between the bone ends is susceptible to shearing and rotation strain. The effect of interrupted immobilization is even more striking than in the case of closed fractures.

No other measure is needed than to remove the sequestrum and immobilize the fracture in plaster; the fractured surfaces require no freshening; the bone cavity and the sinus must under no circumstances be scraped; no bone-graft is needed; no plate or screws should be employed. Scraping is harmful because it produces as many new sequestra as it removes. The insertion of a bonegraft is obviously wrong when the purpose of the operation is to remove dead bone. Similarly it is wrong to insert plates and screws. The fact that vitallium is "inert" and "silent" in healed wounds does not alter the fact that it is a sequestrum in infected wounds. Even with the assumed protection of chemotherapy, plating of infected fractures is harmful, often dangerous, and always unnecessary.

ROBERT P. MONTGOMERY, M.D.

ORTHOPEDICS IN GENERAL

Stirling, R. I.: "Sciatica"—from an Orthopedic Point of View. *Edinburgh M. J.*, 1943, 50: 155.

The patients whom one sees complaining of "sciatica," or who are referred with a diagnosis of "sciatica," can be divided into three groups.

The first group contains those who have some disturbance in the joints at the lower end of the spine or of the pelvis, and who have referred pain along one or more of the component parts of the sciatic nerve. No change can be demonstrated in the sensory or motor portions of the sciatic nerve. These are not cases of "true sciatica."

The second group consists of those who have symptoms in the sciatic nerve, which originate from pressure on, or strain or irritation of, the nerve or its roots. The pressure or strain may be caused by congenital or traumatic irregularities, reduction in the size of the intervertebral foramina, inflammatory changes, or neoplastic growths inside or outside of the spinal canal. Usually in such cases there is some alteration in the sensory, if not in the motor side of the sciatic nerve. They may be grouped as examples of "symptomatic sciatica," but they are not cases of "true sciatica."

The third group is formed by cases of "true sciatica," i.e. interstitial neuritis of the sciatic nerve trunk. This group forms only 5 per cent of the cases seen. The patient exhibits tenderness and swelling in the nerve trunk and alterations in its sensory and motor distribution.

The greatest number of cases in group I are due to a derangement of one of the sacroiliac joints, but some are due to derangements of the lumbosacral joints, and a few are due to disturbances in the joints between the fourth and fifth lumbar vertebrae.

A gross strain of the sacroiliac joint may be due to severe violence by which the controlling ligaments are torn or stretched, and the hills and hollows in the noncartilaginous part of the joint are overlapped so that the joint surfaces are held apart forcibly. The pain in such cases is excruciating and is usually referred along the sciatic nerve as well as being felt locally. Immediate comfort is secured by manipulative replacement. The more common sacroiliac strain, however, does not follow severe trauma, but is due to the effects of bad posture accentuated by a comparatively trivial injury, such as catching the heel on a step while descending a stair or by a sudden muscular effort, as in lifting a heavy suitcase.

The differential diagnosis between lumbosacral and sacroiliac referred pain is made by moving the respective joints and reproducing the pain by such movements. The examination should be carried out (1) with the patient standing, (2) with the patient sitting, and (3) with the patient lying down. There is obviously no time to give a description of a full examination, which requires the best part of half an hour. The main points, in so far as they refer to sciatic pain, can be stated briefly:

1. With the patient standing, a careful inspection is made. A scoliosis may or may not be present, but it usually becomes evident when the patient is asked to bend forward to touch his toes, keeping the knees straight. In the case of sacroiliac joint trouble it is seen that the lumbar spine moves evenly and fully until it is in complete flexion, and that the pelvis tilts as a whole until a pull is put upon the flexor muscles of the knee, which arise from the ischial tuberosity. The patient then stops bending, or flexes the knee on the affected side because he feels referred pain down the leg. Since the patient has an affected sacroiliac joint no pain will be felt while the pelvis tilts as a whole, but as soon as the innominate bones have to stretch the hamstrings, in order to

tilt forward, it is necessary that the sacrum should rotate forward so that the flexion force can be transmitted through the sacroiliac joints to the innominate bones. As this requires movement at the sacroiliac joints the patient immediately feels referred pain. When the disturbance is in the lumbosacral joints and the individual bends forward, the lumbosacral joints, and usually the fourth and fifth lumbar joints, are held absolutely rigid.

2. If the patient is sitting down and he has sacroiliac joint strain, he can touch his toes without any referred pain because the bending of the knees slackens off the flexor muscles and allows the pelvis to tilt without any movement at the sacroiliac joints. The individual with lumbosacral strain, however, usually has referred pain because the lower part of the spine must still be held rigid, and unless the other joints are sufficiently lax to allow him to touch his toes, the affected lumbosacral joints will have strain put upon them.

3. When the patient is recumbent, the chief test is the straight-leg raising test. Others, such as rotation to put torsion on the lumbar spine and sacroiliac joints, and lateral pressure are also valuable.

To clarify the mechanism of the straight-leg raising test let us presume that the individual has an affected left sacroiliac joint. With the patient lying perfectly supine, the right leg is raised with the knee straight and the foot pointed, and the raising is continued until the individual complains of pain. Occasionally this pain is first felt behind the right knee, but the examination should not stop there. The leg should be pushed further up, when the pain will be found to pass down the left leg. Probably the right leg will be raised to 80 degrees. It will be seen that in the first stage the movement takes place entirely in the hip joint, but when the flexors of the knee are tightened and a pull is put on the ischial tuberosity, the upper part of the ilium on the right side is rotated backward—the movement taking place at the right sacroiliac joint. This movement can continue for about 10 degrees. Further movement of the leg upward is then permitted only by tilting the sacrum. This, however, entails movement in the left sacroiliac joint, i.e. the sacrum is rotated backward while the left ilium lags behind. Movement being thus forced upon the affected left sacroiliac joint, referred pain is experienced down the sciatic distribution on the left side. The right leg is lowered and the left leg is raised in turn, and, if there is no additional complicating factor, it will be possible to raise it about 70 degrees before the referred pain is felt down the left leg, that is, as soon as the left sacroiliac joint begins to be moved. If the left leg is now dropped down a matter of 10 degrees until the referred pain has gone entirely and the foot, which was plantar flexed, is dorsiflexed, there will be a return of the pain if there is any neuritis in the nerve or fixation of the nerve roots, because this movement stretches the posterior tibial nerve and through it the sciatics nerve. If, however, there is no complicating factor in the sacroiliac strain there will be no pain.

When the straight-leg raising test is applied to a patient with lumbosacral joint strain it will be noted that pain will be experienced as soon as the lumbosacral joints move, i.e. as soon as the sacrum begins to rotate backward. It is obvious that the sacrum will be made to rotate when the legs are raised to the same level.

Group 2 presents by far the most puzzling problems. In the vast majority of cases some alteration is brought about by the pressure on, stretching of, or interference with the nerve roots or the nerve itself, and therefore there is usually not only some loss of musculature, which varies with the part of the nerve affected, but there is some sensory disturbance and, not infrequently, a loss of the ankle jerk. Again, as with the first group, the referred pain is usually along the line of the fifth-lumbar or first-sacral nerve distribution, i.e. the area to the outer anterior and slightly posterior aspect of the leg, and the lateral part of the foot. Occasionally, it is apparent in the cleft between the first and second toes. There may be complete anesthesia, lack of appreciation of sharp or blunt points, failure to distinguish between heat and cold or between caliper points, and loss of position sense of the small toe. Occasionally there is hyperesthesia.

The main causal factors are:

1. Static arthritis or osteoarthritis of the sacroiliac or lumbosacral joints
2. Sacralization of the fifth lumbar transverse process
3. Spondylolisthesis
4. Infections or tumors abutting the lumbosacral or sacroiliac joints
5. Radiculitis
6. Prolapse of the nucleus pulposus and thickening of the ligamentum flavum
7. Tumors or inflammation in the spinal canal
8. Tumors or inflammation outside of the spinal canal
9. Fibrositis

In cases of "true sciatica," group 3, there is almost certainly an infective factor in the body, and a most careful examination has to be made for it so that it can be eliminated. Probably the most common sites are in the teeth, nasopharynx, gall bladder, large bowel, and the genitourinary system, but metallic poisoning and an abnormal carbohydrate metabolism must not be forgotten. The active signs of "sciatica" may vary but the pain is persistent. The nerve is tender and swollen and there is always some sign of interference with its conductivity.

The treatment of patients in group 1, i.e. those with sacroiliac strain, is manipulation of the joint to break down adhesions, and restoration of the musculature with the assumption of the proper posture. In a chronic case the patient cannot be treated adequately as an outpatient. In-patient treatment from a fortnight to three weeks is required at the very least. Patients should be nursed on a hard bed; should have fomentations for twenty-four hours, following the manipulation; should then have mas-

sage to eliminate the thickening around the joint and the fibrositis present in the large muscles controlling the joint, and graded exercises should be carried out frequently during the day until the patient is able to get up more and more. The time up must, of necessity, vary with the patient, and is controlled entirely by the length of time the patient can hold the proper attitude while standing, walking, or sitting. In the grosser cases a brace may have to be worn, or the joint may have to be fused, but the vast majority should be treated by manipulation at first.

Strain of the lumbosacral joint is similarly treated by manipulation, but if the strain is of longer duration and there are some changes in the joints, the temporary wearing of a brace is of inestimable value.

Congenital or acquired conditions causing strain on the sacroiliac and low lumbar joints must be corrected, if possible. Dislocated hips should be replaced or bifurcation operations carried out, or in the case of congenital tight iliotibial bands, these should be sectioned across as a preliminary to postural exercises. Osteotomies may have to be performed on the femur or leg bones before a good weight-bearing posture is possible.

In cases of static arthritis (group 2) treatment should consist of restoring proper posture so that the weight of the body falls in the correct line on the affected joints. Usually, if the joints are mobilized and the muscles are developed, a correct weight-bearing posture will result. Occasionally, rest in a plaster shell and the wearing of a brace is necessary, and if this proves ineffective, a local fusion may have to be carried out.

In cases of sacralization, the condition is a congenital one and yet it seldom causes symptoms until the patients are over thirty years of age, that is, until the resiliency of youth is passing and posture is apt to become poor. Consequently, the restoration of correct posture and the temporary wearing of a brace will cure most cases. In persistent cases removal of the abnormal process may have to be carried out.

Most of the early cases of spondylolisthesis do very well with physical therapy, with strengthening of the muscles, and, occasionally, with the wearing of a brace. If the symptoms persist, however, or the displacement is seen to be increasing, a fusion of the part is indicated. The fusion can be carried out either from behind or in front.

Infections or tumors abutting the lumbosacral or sacroiliac joints should be dealt with on general lines.

Treatment of radiculitis consists of loosening the adherent nerve sheaths at the intervertebral foramina. This can be done in some cases by forcibly flexing the straight leg at the hip (under anesthesia) to stretch the sciatic nerve. An alternative method is an epidural injection by which saline solution is injected into the epidural space. As the separation is taking place the person has acute pain in the sciatic nerve, such as he experienced before. In gross cases an operative release in the area may have to be carried out with or without section of the posterior nerve roots. When carrying out the epidural injection it is advisable to insert a local anesthetic to anesthetize the part and make it possible to manipulate the sacroiliac joint and stretch the leg. This is indicated because, if the case of radiculitis has persisted for any length of time, there is almost certain to be a stiffening of the joints and thickening of the ligaments.

In cases of prolapse of the nucleus pulposus and thickening of the ligamentum flavum, nature's method is to produce a reverse lumbar curve. In a very large number of cases of prolapse of the disc and thickening of the ligamentum flavum, if the individual has still a lordosis, relief of symptoms, which may persist for years, can be obtained by improving the posture until the lordosis has been obliterated and, indeed, until an almost straight lumbar spine has been achieved. It is a wise rule to try every orthopedic procedure to relieve this condition before recourse is made to operation. Even if operation has to be carried out in the end, the preliminary limbering up shortens convalescence considerably.

It is sometimes exceedingly difficult to differentiate between a prolapse of the nucleus pulposus and a thickened ligamentum flavum, on the one hand, and radiculitis on the other. Considerable help is sometimes obtained by giving an epidural injection, because, as the fluid is inserted, one can frequently tell whether the pain produced is due to radiculitis or to a nuclear prolapse. In the former case, if adhesions separate, the pain is relieved. In the latter, the pain is more apt to persist. One takes it as a rule that if the symptoms are those of a nucleus pulposus and if an epidural injection and postural correction do not bring about relief, the case should be explored forthwith without recourse to lipiodol injection. Formerly the operation was rather a formidable one, necessitating laminectomy of several vertebrae, opening of the dura, and, finally, bone-grafting. Now, however, it has been found possible to remove the nucleus pulposus through the gap between contiguous laminae, without removal of any bone. Occasionally, a small portion of bone may have to be removed from the upper or lower lamina, but even a hemi-laminectomy is unnecessary. During this approach the ligamentum flavum has to be removed in toto, and therefore if it is responsible for the symptoms the operation will have been successful.

Tumors and infections inside of the spinal canal must be investigated and dealt with in the normal way.

Tumors outside of the spinal canal of whatever origin should be removed or irradiated according to their nature.

Fibrositis in muscles is usually treated by removal of septic foci, the application of local heat and massage, the ingestion of alkalis, occasionally by the injection of a local anesthetic, and always by muscle re-education. In menopausal cases, pro-

gynon, or its equivalent, may be required. If the condition is very acute, however, rest for ten days in a plaster shell will often prove to be very beneficial. Needless to say, massage of the piriformis muscle is out of the question. Section of the piriformis tendon has been suggested. Stirling has seen only 2 cases of the condition and both quieted down with rest and alkalization.

True sciatica, group 3, should be treated by rest until the acute symptoms have subsided. The rest may be given by weight traction of 8 to 10 lb., or in severe cases by the application of a plaster-of-Paris spica. Medication with vitamin B seems to be of doubtful value. When the condition has settled down, muscle re-education must be undertaken. Occasionally adhesions form in the nerve, but usually these are severe only in cases in which rest has not been instituted. When adhesions are present the nerve should be stretched under an anesthetic and the stretching should be followed by a course of physical therapy. The injection of a saline solution into the nerve trunk may serve the same purpose as the stretching, but the results are much less certain. The injection of the nerve with potent local anesthetics is usually disappointing and may be dangerous.

It cannot be overemphasized, however, that, whatever may have been the original cause of the trouble, until good posture has been restored the treatment of the case is not complete.

ROBERT T. MCELVENNY, M.D.

Lapidus, P. W.: Misconception about the "Springiness" of the Longitudinal Arch of the Foot. Mechanics of the Arch of the Foot. *Arch. Surg.*, 1943, 46: 410.

The anatomy and dynamics of the foot are discussed very thoroughly; also the role of the ligaments and muscles in the maintenance of the longitudinal arch. There is a definite shock-absorbing function of the foot in locomotion. The human foot is a rigid lever and possesses no "springiness."

The ligamentous structures of the foot have a definite elasticity in that they are able to stretch and resume their original length, but they should be considered as nonyielding structures. The longitudinal arch of the human foot cannot be considered as a real masonry arch as it is the result of the foot's being built as a trussed structure. The ligaments are mainly responsible for the integrity of the longitudinal arch, the plantar fascia acting as a tie rod of the truss.

Idiopathic "flat foot" is probably a congenital or hereditary malformation and is not due to faulty muscular function. RICHARD J. BENNETT, JR., M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Siegling, J. A.: Intravenous Migration of a Metallic Foreign Body. *War Med.*, Chic., 1943, 3: 303.

The author reports a case of intravenous migration of a metallic foreign body.

A negro laborer, thirty years old, had been striking a cold chisel with a hammer and while doing so felt sudden pain in his left forearm. There was a small wound on the volar surface just distal to the cubital fossa. There was free bleeding and he reported to the hospital immediately. A roentgenogram revealed a small metallic foreign body 5 cm. proximal to the cutaneous wound. Steps were taken for its removal under fluoroscopic control. By the time the surgical field was prepared, no foreign body was visible under the fluoroscope in this area and none was shown by another roentgenogram as well. On the following day a roentgen examination of the chest revealed a foreign body in the lower lobe of the right lung near the periphery between the eighth and ninth ribs. The author concluded that when the patient was recumbent and the arm elevated for surgical preparation, the intravascular foreign body, assisted by gravity and the venous current, moved through the subclavian vein into the right auricle. Coursing on into the right ventricle it then was pumped through the pulmonary artery and filtered out in the lung. No local symptoms occurred and when the laborer was seen six months after the accident, he stated that he had never experienced any symptoms referable to his chest.

Because of the possibility of similar cases being observed in the armed forces, most of the literature on intravascular migration of projectiles is reviewed by the author. It is evident that the final resting place and symptoms of a projectile penetrating a vascular channel depend on whether it has perforated a vein or an artery. Reports of the migration of foreign bodies in veins are more numerous and the symptoms in general are less dramatic.

In experimenting on dogs, particles of lead and grains of rice were introduced into the circulation. The behavior of metallic foreign bodies in veins was found to differ from their behavior in the artery. In the latter vessels the blood pressure is sufficient to overcome the weight of the metallic foreign body, whereas in the veins the weight of the object overcomes the feeble pressure of the venous stream. The grains of rice, in contradistinction to the metallic particles, always follow the course of the blood.

HERBERT F. THURSTON, M.D.

Homans, J.: Circulatory Deficiency in the Extremities in Relation to Medicolegal Problems. *Ann. Int. M.*, 1943, 18: 518.

The lower extremities are the ones most seriously affected both by arteriosclerosis and thromboangiitis obliterans. Arteriosclerosis is found in elderly individuals (about sixty years old) and affects the walls of large- and medium-sized arteries which lose their elasticity. Calcium salts are deposited. Mural thrombi form and restrict the blood flow to the periphery which causes the tissues supplied by these arteries to shrink and to become inelastic and fibrous. Skin, fat, and muscles are equally affected. If added thrombosis occludes completely one or several arteries, gangrene of some terminal part of the limb sets in. Necrotic tissues invariably become infected and finally a line of demarcation forms, separating the dead from the viable tissue. After weeks, or even months, the necrotic tissue is cast off and healing may occur spontaneously.

Coldness and pallor of the feet and lower extremities and moderate muscular atrophy are the premonitory symptoms. A peculiar lameness, known as "intermittent claudication," regularly sets in when the patient walks for any length of time. This cramplike pain is relieved by rest but returns after the same amount of exercise. These complaints are due to the deficient blood supply or to the accumulation of waste products. The later stage of arteriosclerosis is characterized by a bluish-red discoloration of the toes on dependency and by pain, especially on elevation. Small necrotic areas appear on the tips of the toes near the toenails or over bony prominences. In very advanced cases gangrene of the toes and feet is found, the infection may spread by way of the lymphatics or subcutaneous tissue, and give rise to lymphangitis or cellulitis, respectively. In diabetes the same symptoms are found, but usually in younger individuals, and once infection sets in the condition is often fatal because the tissues lack the resistance necessary to combat infection. The disease progresses slowly and usually unnoticed until it reaches a stage where it becomes destructive.

There are several tests which are helpful in discovering arterial deficiency:

1. Color changes. Pink varying from a very pale tint to almost red indicates normal circulation. In evaluation of this test the surrounding temperature has to be taken into consideration.

A white cold extremity indicates obstruction of the arterial circulation.

A blue cold extremity indicates greatly diminished circulation.

A red cold extremity indicates, like the preceding, diminished circulation; however, the blood has not given up its oxygen.

A red hot extremity indicates inflammation. Inflammation causes some increase in temperature even in extremities with deficient circulation.

2. Elevation and depression. The feet are elevated to an angle of about 30 degrees with the horizon for two minutes and the pink color is studied by compression of the tip of the toe. The white com-

pression spot should regain its color within a few seconds. Then the feet are lowered and it should take about five seconds for the pink color to reappear. From twenty to thirty seconds indicates a restricted arterial flow. A bluish-red color in an extremity allowed to be dependent indicates very poor arterial circulation.

3. The pulses of the feet usually correspond with the presence or absence of deficient arterial circulation. Only on rare occasions does the absence of pulsations in the large arteries not indicate deficient circulation. In these instances the collateral circulation is able to replace the normal flow of blood.

4. Roentgen-ray study. In the absence of clinical signs of arteriosclerosis and deficient arterial circulation, the visualization of calcification of the arterial walls does not indicate actual arterial deficiency, but in the presence of clinical findings, calcification of the arterial walls in the roentgenogram helps to confirm circulatory deficiency due to arteriosclerosis.

In case of injury, i.e., a blow, repair of the tissues (except bone) normally requires from eight to twelve days excluding infection. In arteriosclerosis the inelastic, narrow arteries are unable to supply the necessary amount of blood and the injured tissue recovers very slowly or not at all. The accumulation of exudate (swelling) in the injured area normally compresses arteries as well as veins locally. Inelastic, hardened arteries are not compressed by the swelling and blood continues to pour into the part. The compressed veins, however, are unable to carry away the excess amount and a vicious circle is set up with the result of total circulatory failure.

Arteriosclerotic arterial walls are brittle. They are easily injured and thrombosis occurs within their lumen which cuts down the blood supply to the terminal part. Twenty-four hours after a serious injury the most dependent portion of the extremity might show a bluish-red discoloration and gangrene might set in within a few days. These changes are accompanied by pain which is increased by elevation of the affected extremity. On rare occasions, a blow to the popliteal space or the calf without signs of ecchymosis or swelling may cause circulatory deficiency and, ultimately, gangrene of some portion of the extremity. Even a not unusually severe blow may produce an occluding thrombosis within the inelastic and brittle popliteal artery. Cuts and abrasions create a similar situation. Repair is not forthcoming and the wound is subject to infection. The infection spreads, as a rule, quite early because the inflammatory wall, insufficiently built up around the infection, is easily broken down.

A temperature easily borne by vascular tissue causes destruction (burn) of avascular tissue. Heat applied to a part causes locally increased metabolism and blood must be supplied freely. In case of deficient circulation the supplied quantity of blood is not sufficient to support the increased activity and the tissues break down. Cold is well tolerated by tissues with deficient circulation. When frozen, however, the tissues die.

Thromboangiitis obliterans (Buerger's disease) is found almost exclusively in young males and affects medium-sized veins and arteries. Its cause is not known. A possible relation of dermatophytosis and onychomycoses (athlete's foot) and Buerger's disease has been considered. The tissues apparently become oversensitive to the protein of the fungi. Treatment of fungi infection influences the progress of the disease favorably. Tobacco smoking usually aggravates the condition.

The basic lesion is an inflammation of the vessel walls and is invariably followed by thrombosis. Buerger reports abscess formation within the walls and within the thrombi of the superficial veins (outside the muscle mass). The author found abscess formation in only one-third of the cases.

The symptoms of thromboangiitis obliterans are similar to the ones observed in arteriosclerosis. Slight coldness and sometimes numbness in the toes are found in the early stage of the disease. Atrophy usually is absent. In the later stage spontaneous burning pain is experienced in the extremity, which is made worse on elevation and is diminished on lowering of the limb. A bluish-red discoloration of the toes is noticed. Gangrene occurs in the late stage of the disease. There is a somewhat better resistance to infection. Uncontrollable pain is much more severe and usually enforces amputation rather than gangrene. Trauma and thermal injuries hasten the course of the disease just as in vascular arteriosclerotic disease.

In conclusion, the economic aspects of both arteriosclerotic vascular disease and thromboangiitis obliterans are discussed. GEORGE I. REISS, M.D.

Blakemore, A. H., Lord, J. W., Jr., and Stefko, P. L.: Restoration of the Blood Flow in Damaged Arteries. *Ann. Surg.*, 1943, 117: 481.

In the last World War 4,403 U. S. soldiers lost one or more extremities, and of this number only 13 per cent lost their limbs in battle. The majority of the surgical amputations were performed because of infection or serious damage to the blood supply, or both. Suture of severed arteries was generally unsuccessful and was considered impractical.

A recent British war memorandum by Admiral G. Gordon-Taylor and associates states, "The main indication for amputation is irreparable interference with blood supply. No matter how severe the destruction of skin, comminution of bones or contamination of tissues, if the main blood vessels are not destroyed the limb can usually be saved."

The authors believe that the use of the sulfonamides in conjunction with careful débridement and careful hemostasis with the evacuation of blood clot will, for the first time in the history of wars, enable the surgeon to postpone amputation safely in cases of ligated primary arteries until the true status of the collateral circulation is established. Such measures, perhaps in conjunction with the use of anticoagulants, will afford the basis for success of a simple, nonsuture method of arterial anastomosis.

In this war it may be possible to transfer those men who will benefit from arterial anastomosis to a remote base hospital by plane for débridement and evaluation of the status of the collateral circulation, and where experienced surgical teams can care for them. The immediate treatment of the war wound should include control of hemorrhage (preferably by ligation of the bleeding vessels), treatment for shock, and administration of chemotherapy by the first-aid and evacuation units.

The basic requirements of a method of anastomosing blood vessels in the war-wounded include:

1. A high incidence of success when used in badly contaminated wounds for twenty-four, or more, hours after injury
2. Adaptability to the use of vein grafts for bridging arterial defects without complication of the technique or efficiency of the method
3. Simplicity of procedure

In the experiments reported it was found that the nonsuture method with the vitallium double-tube technique, a vein graft, and the use of sulfonamides fulfills all of the requirements.

Clinically this method was used successfully to bridge a combined defect of the popliteal and femoral arteries in a sixty-three-year-old negro following excision of a syphilitic aneurysm. In spite of the presence of marked degenerative arteriosclerosis, gangrene of the leg was avoided.

The nonsuture technique is described in detail. The several methods used in the animal experiments are evaluated. The results are compared with those of the Carrel suture technique for vein grafts. The nonsuture technique succeeds far more regularly in the presence of bacterial contamination than the Carrel suture method.

Some animal experiments showing that heteroplastic vein grafts are successful are presented. Other animal experiments are being conducted with preserved vein grafts.

The article is well illustrated and contains tables of results and a comprehensive bibliography.

JOHN E. KIRKPATRICK, M.D.

Haley, E. R.: Arteriosclerotic Gangrene. A Report on Refrigeration Prior to Amputation. *Arch. Surg.*, 1943, 46: 518.

The author notes that in a community hospital having predominately charity patients, the surgeon is continually faced with the problem of managing cases of gangrene of the toes and feet due to arteriosclerosis.

More often than not the patient does not apply for aid until the condition is well established and he is in an advanced toxic condition, or even moribund. The problem is usually complicated by the advanced age of the patient and the frequently associated heart disease, general toxicity, and diabetes. It is now generally accepted that amputation of the leg is necessary if the gangrene has extended proximal to the toes. The operation often constitutes a desperate emergency for patients with far advanced toxicity, and the results in the past have been persistently discouraging. The work of Allen on the refrigeration of gangrenous limbs gave new hope for many patients who previously would have been lost.

Experiments on rats revealed that gangrene always develops in a rat's tail subjected to a pressure of 130 mm. of mercury for eighteen hours at room temperature, whereas at 1° C. (33.8° F.) it fails to undergo gangrenous changes even after ninety-six hours of the pressure.

The author describes in detail the method for the maintenance of the cooling effect on these limbs so treated. A simple metal box long enough to hold the whole leg was used. The top was open, and a hole at one end permitted entrance of the leg and thigh. A partition, which was movable so as to come to the level of the knee, had a smaller hole through which the leg and foot passed. Finely chipped ice was now added to the lower compartment, to cover the leg to the knee. A half-hour later, when the leg was well numbed by the cold, a tourniquet of good quality gum tubing was placed about it at the level of the tibial tuberosity so that the ice extended an inch or more above the tourniquet. The application of ice for about forty-eight hours was nearly always sufficient to bring the patient to the optimum condition for amputation. Six or eight hours prior to the time for operation the upper compartment was filled with ice, which reached to the upper third of the thigh. A half-hour later a second tourniquet was tied tightly about the thigh 1 in. below the line of chilling and yet definitely above the proposed operative field. This tourniquet was tight enough to occlude the arterial supply unquestionably or the anesthesia would not have been complete. Amputation was performed between the two tourniquets, which were left in place, the anesthesia lasting for at least an hour and a half. After operation a thin dressing was applied to the stump which was then covered with bare ice bags for twenty-four hours.

The author presents in detail the history of the management of 4 cases. He notes that when the limb was first chilled it ached moderately for ten or fifteen minutes, but no patient complained more than just to mention it. In cases in which there was severe pain from the gangrene, the ice afforded a definite relief. The discomfort from the application of the tourniquet was in no way excessive if the leg had been well chilled. By far the most dramatic and convincing factor of this whole management was the tremendous change for the better which occurred in the first twenty-four hours. In every case the temperature of the patients with only gangrene and spreading cellulitis fell to normal within twelve hours of the application of the ice-tourniquet treatment.

Critical evaluation is made of the second phase of the treatment, viz., the use of the ice-tourniquet technique to produce anesthesia. At first there was a tendency to believe that eventually ice-tourniquet management would be reserved as a preoperative

measure for patients in a critical condition and badly in need of supportive measures prior to operation. Because of this belief, spinal anesthesia was used for amputations on relatively strong patients without complications. It was noted that the patients having their legs amputated under the ice-tourniquet anesthesia were much stronger and more co-operative postoperatively, while when spinal anesthesia was used, frail patients were profoundly depressed for thirty-six or forty-eight hours after operation. The postoperative temperature took nine days, on the average, to return to normal after spinal anesthesia, whereas it took only four and one-half days to become normal after ice-tourniquet anesthesia. Better drainage due to chilling may well be the reason for the difference.

In conclusion, the author notes that the ice-tourniquet treatment has a very definite place as a preoperative measure in the management of debilitated patients with gangrene. Operative or postoperative reactions following the use of the ice-tourniquet method for anesthesia are slight compared with those following the use of spinal anesthesia. The need for preoperative and postoperative sedation is practically eliminated. The stump is apparently not harmed by the ice-tourniquet treatment, and healing is perfectly satisfactory.

HERBERT F. THURSTON, M.D.

Learmonth, J. R.: Reflex Vasodilatation in Surgery. *Edinburgh M. J.*, 1943, 50: 140.

In the practical management of many surgical conditions the determining factor is the amount of blood reaching the part. Under normal conditions of volume, pressure, and blood count, the sum of the calibers of the individual arteries and arterioles is the determining factor. The caliber of these vessels is controlled partially by the autonomic nervous system and partially by hormones. The regulating mechanism of the vessels of the skin and subcutaneous tissues is predominantly nervous, normally exerted by a continuous vasoconstrictor tone. When these inpulses are inhibited or interrupted the vessels dilate, which increases the flow of blood through them. On the other hand, products of the metabolism of a working muscle probably dilate the vessels.

A thermocouple to measure the temperature of the skin, attached to an electrical recording device, provides a convenient method of comparing the amounts of blood flowing through the subcutaneous tissues of an extremity under different conditions. When complete dilatation has been obtained in young healthy adults, the skin temperature is around 34° C. More precise values may be obtained by enclosing the part in a plethysmograph. The average increase in normal subjects has been measured as 168 per cent. Such large increases can be obtained only when there is no spasm or organic disease of the main vessels and their collateral branches.

The remainder of the article deals with the problem of securing a maximal blood supply in certain surgical conditions involving the extremities.

Two broad groups of lesions can be recognized. The first comprises infections and injuries, in which a better than normal supply is needed for healing and to prevent spread of infection. The normal response is active hyperemia. A breakdown of this mechanism occurs when a large artery is injured. The second group is one in which the blood supply to a part has been reduced to a level which leaves no available surplus to provide for repair or for defense against infection. Cases belonging to this second group include arteriosclerosis and thromboangiitis obliterans. The effect of thrombi and emboli in diseased and injured vessels is aggravated by reflex spasm of the collateral vessels.

If procedures designed to interrupt the sympathetic vasoconstrictor nerves to a limb, temporarily or permanently, are left out of consideration, then heat emerges as the effective clinical stimulus to produce vasodilatation. It may be applied to the affected part when that part has an unimpaired blood supply. It is unreservedly condemned when the nutrition of the part is already precarious. The author quotes Sir Thomas Lewis to the effect that local application of heat in such cases increases the metabolism of such a part and produces a relative ischemia, and that hot applications to an ulcer on the toe of an arteriosclerotic may produce and spread gangrene. The second method is applying heat at a distance from the affected part. Stewart in 1911 showed that if the legs or arms were heated, vasodilatation occurred in the unheated limbs after an interval. This was confirmed twenty years later by Landis and Gibbon.

The author has used this method by applying heat (in the form of cages warmed by electric lights) to the unaffected limbs and to the trunk. Precautions to keep the affected member dry and warm and to see that the patient received adequate liquids were taken.

Theoretically the method is applicable only when the blood vessels are capable of dilating and when the sympathetic nerve supply is intact. The author has found it of value in some cases of threatened arteriosclerotic gangrene, in which improvement to the point of making amputation no longer imperative was obtained. However, it is not used when gangrene has already set in. He also stresses that the method is disappointing when there has been an injury both to the artery and to the nerves of a limb. On the other hand, damage to an artery can cause spasm of the collateral circulation even when the nerve to the limb has been severed. He advises therefore, that at least in childhood, youth, and young adulthood, when there is no response to such attempts at reflex dilatation, the wound, especially when of the main artery, should be re-explored for an injury causing reflex spasm. The author has found the method of value also in embolism of a main artery; in aneurysm to tide over a temporary circulatory deficiency; in pyogenic conditions of the hand or foot, especially after drainage; in ulcers of the extremities, especially when acral; and in skin

grafting. In musculotendinous lesions, when the repair of tendons must be undertaken in the hand often robbed of direct blood supply by the original accident, the local blood supply may be improved by this procedure.

In cases in which a condition akin to ischemic contracture has supervened on an injury to the brachial artery, even in a healthy young adult, the method has nothing to offer.

MARIAN BARNES, M.D.

BLOOD; TRANSFUSION

Gray, P. A., and Elliot, A. H.: The Specific Gravity of Whole Blood and Serum. *Am. J. M. Sc.*, 1943, 205: 356.

Normal values for the specific gravity of serum and of whole blood were determined by means of the Barbour and Hamilton falling-drop technique. The influence of such physiological factors as menstruation, pregnancy, age, and daily variation were studied. The influence of pathological states upon the specific gravity of the blood was observed in the variation from normal of certain blood constituents such as the red blood cells, the serum protein, and the water content. The correlation between the red blood-cell count and the specific gravity of the whole blood was also determined.

The authors illustrate the practical application of this technique in 2 cases for the estimation of the fluid need in the postoperative state, and recommend its value in treatment.

WALTER H. NADLER, M.D.

Alstead, S.: The Rate of Blood Regeneration after Hemorrhage. *Lancet*, Lond., 1943, 244: 424.

The rate of hemoglobin regeneration after hemorrhage produced by venesection was studied in 48 male patients ranging in ages from twenty-seven to ninety-two years and selected in the hospital from among conditions not related to the hematopoietic system. The subjects were maintained on a regular hospital diet which contained 12.6 mgm. of iron daily. The average amount of blood withdrawn by venesection was 710 cc. Hemoglobin determinations were made at frequent intervals with the Altman hemoglobinometer on the basis of the Sahli principle.

In less than half the cases the lowest hemoglobin level was reached between twenty-four and seventy-two hours after hemorrhage, while in the others an average of seven days elapsed before that level was reached. The fall in hemoglobin concentration and the duration of hemoglobinemia after hemorrhage were not related directly to the amount of blood withdrawn, but depended on the rate of transfer of the fluid reserves from the tissue spaces into the blood. Hemodilution accounted for the long period of anemia which was manifest even after five weeks in 50 per cent of the subjects. The age of the patient did not seem to influence the rate of regeneration of hemoglobin. The variability in the rate of hemodilution, the discharge of red cells from the spleen, and the generation of other red cells from the marrow made it impossible to calculate by arithmetical means the resultant concentration of hemoglobin following the loss of a known volume of blood.

BENJAMIN G. P. SHAFIROFF, M.D.

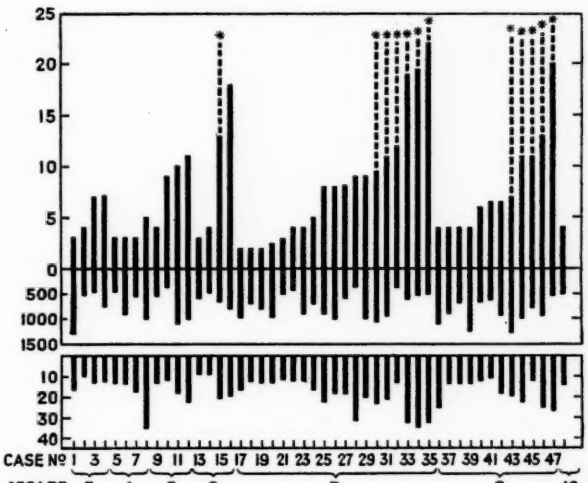

Fig. 1. Recovery-time, amount of venesection and initial depression of hemoglobin in 48 cases. In the 12 cases marked with an asterisk the hemoglobin became stabilized but did not return to its prevenesection figure.

Castex, M. R., and Pavlovsky, A.: Lyophiled Human Milk and Cream. Preservation of the Accelerating Effect on Blood Coagulation (Leche y crema humanas lyofilizadas. Conservación del poder acelerador de la coagulación de la sangre.). *Bol. Acad. nac. med. B. Aires*, 1942, No. 6: 477.

In a previous communication the authors reported results of their investigation of the coagulating effect of human milk or cream, which corroborated Solé's observations. They concluded that the effect is due to high thromboplastine contents of milk or cream, respectively. In course of time the coagulating effect of the aforementioned substances diminishes. After addition of acetone to human cream, the insoluble residue preserves its coagulating effect for a certain time. A local application of this hemostatic agent furnishes beneficial results in hemorrhages of hemophilic individuals.

In this article the authors describe their experiments with preservation of the factor which exerts an anticoagulating effect. For the purpose of preservation the authors employed the lyophil method. They found that lyophiled human milk or cream preserved its coagulating effect 97 days in 1 case and approximately four months in another case. The authors conclude from their investigation that the lyophil method may be recommended for preservation of thromboplastin in various substances which possess a coagulating effect.

JOSEPH K. NARAT, M.D

Maynard, M. T.-R., and Hollinger, N.: Thrombocyte Deficit. The Behavior of the Blood Platelets in Diseases of Vascular Stasis of the Extremities. *J. Am. M. Ass.*, 1943, 121: 1194.

Because of the accidental observation that thrombocytes were definitely diminished within the capillaries of the feet of persons who suffered from chronic stasis diseases of the leg and of those with chronic lichen simplex of the same areas, the procedure designated the "thrombocyte deficit" test has been applied by the author in more than 200 cases.

The basis of this study has been a comparison of the platelet counts on blood taken from the ear with counts on blood taken immediately from the right and left foot. A preliminary report of the method is presented.

The local diminution of thrombocytes is probably an indication of the degree of vascular damage; it often parallels the local clinical conditions, of which the most important is the vicious circle of vascular stasis. It should have therapeutic and prognostic significance. WALTER H. NADLER, M.D.

Levine, P., and Wong, H.: The Incidence of the RH Factor and Erythroblastosis Fetalis in the Chinese. *Am. J. Obst.*, 1943, 45: 832.

Hitherto, studies on the distribution of the blood groups and on other blood factors in various races were of academic interest only. However, this viewpoint has been considerably altered by the findings presented on the correlation of the incidence of erythroblastosis fetalis and the Rh negative reactions obtained with anti-Rh serum or anti-Rh. The possibility of this relationship for the colored and white races was already suspected, but it is definitely established on the basis of the more striking differences between the white and Chinese population.

TABLE I.—AGGLUTINATION REACTIONS WITH HUMAN ANTI-RH SERA

Number tested	Anti-$RH_{1, 2}$		Anti-RH_1		Anti-RH_2	
	+	−	+	−	+	−
334 White	87.0	13.0	85.0	15.0	73.0	27.0
150 Chinese	99.3	0.7	99.3	0.7	93.0	7.0

EDWARD L. CORNELL, M.D.

De Burgh, P. M., and Lyons, R. N.: Precipitation in Stored Human Serum. A Preliminary Note on the Factors Concerned. *Med. J. Australia*, 1943, 1: 298.

Pooled human serum kept at refrigerator or room temperature may become turbid, or a flocculent precipitate may develop in it. Serum in which such precipitate is present has been administered through a muslin filter on numerous occasions without harmful reactions, but such turbid serum has the disadvantage that its turbidity is indistinguishable from that due to contamination with molds or bacteria.

In the method of preparing serum there was delay in adding calcium chloride, and in such serum a heavy precipitate subsequently formed. This precipitate is mainly protein in nature, and it derives from fibrinogen, which remains in the serum as a result of incomplete clotting of the plasma. According to this hypothesis, fibrinogen—known to be the most labile of the plasma proteins—undergoes progressive changes which finally result in precipitation. Since the precipitate in stored serum consists mainly of altered fibrinogen, it is clearly desirable to remove fibrinogen as completely as possible from the plasma. The addition of calcium chloride at the earliest possible moment after separation of the plasma from the corpuscles should remove the fibrinogen completely, since the thromboplastin content of the plasma will be at its highest level and the fibrinogen will not have undergone any degenerative changes.

In view of these considerations it was decided to modify the method of preparation described at first, and (a) to clot plasma as soon as possible after obtaining it from the donors and (b) to add "merthiolate" to the plasma at the time of clotting. Four months after the adoption of this procedure 1,800 liters of serum were examined for turbidity and precipitation. Less than 5 per cent of the samples were slightly turbid, and in some there was a slight precipitate. Prior to the introduction of these changes, over 90 per cent of the samples showed both turbidity and heavy precipitation.

CHARLES BARON, M.D.

Beeson, P. B.: Jaundice Occurring after the Transfusion of Blood or Plasma. *J. Am. M. Ass.*, 1943, 121: 1332.

Seven persons who had received transfusions of blood or plasma at the time of injuries or surgical operations became ill one to four months afterward, with symptoms resembling those of catarrhal jaundice. The purpose of this communication is to report these cases of jaundice and to suggest that these illnesses were probably caused by the transfusions.

Basis for the suggestion is a number of reported instances in which immunizations against different diseases with hemologous serum, plasma, or lymph have resulted in the occurrence of jaundice in significant numbers of the recipients. A distinctive feature in these outbreaks has been a long incubation period, varying from one to seven months. Isolated cases, such as those reported here, may be occurring more frequently than is appreciated. Yellow-fever vaccination, with vaccines containing human serum, has been the cause of several outbreaks of hepatitis. Evidence has pointed to the human serum in the vaccines as the source of jaundice in each of these outbreaks; as a consequence the vaccines now being used are made without human serum.

The clinical features of these illnesses have resembled to some extent those of common infective hepatitis or catarrhal jaundice. In the cases among American soldiers which followed yellow-fever vaccination, the fatality rate was stated to be about 0.2 per cent, but in English children who received measles convalescent plasma, the disease was much more severe, there being 8 fatalities among 41 cases.

Comparable with the foregoing experiences in human beings are some observations which have been made in horses. Jaundice has been noted in horses from one to six months after they have received injections of horse blood or serum given for the purpose of immunization against such diseases as African horse sickness, equine encephalomyelitis, anthrax and grass sickness. The cause of these diseases has not been established, but the explanation which has generally been favored is that the jaundice is caused by a virus which happened to be present in the body fluids of the donors and which, after a long incubation period, produced a hepatitis in the recipient. Another suggestion is that this disease is the result of an immune mechanism in which, following inoculation with hemologous blood or plama, an individual develops antibodies which cause injury to his own tissues.

The author presents the principal data of the 7 cases in tabulations. The clinical diagnosis which had been made in 6 of them was acute catarrhal jaundice, while a diagnosis of toxic hepatitis had been made in 1 case. None of the patients was severely ill. A point of interest is the fact that a skin eruption and joint pains were the initial symptoms in one case and in another the initial symptom was a generalized urticaria. Skin eruptions and arthritis have occurred frequently in "hemologous serum jaundice."

Four of these 7 patients received four or more transfusions involving relatively large volumes of blood or plasma. The volume alone does not seem to be an important factor, since the volume of human serum or plasma which caused the postvaccination cases was comparatively small. The author suggests that two practical measures are indicated for the investigation of this problem. First, a careful record should be kept of the source of blood or plasma administered to each patient. Second, a small portion of blood or plasma should be set aside at the time a transfusion is given, so that, in the event of subsequent cases of hepatitis, some of it will be available for study. HERBERT F. THURSTON, M.D.

LYMPH GLANDS AND LYMPHATIC VESSELS

Warren, S.: The Distribution of Doses of Radioactive Phosphorus in Leucemic Patients. *Cancer Res.*, 1943, 3: 334.

The therapeutic value of radioactive phosphorus, first utilized by Lawrence for the treatment of leucemia, is being rapidly established. In general it may be said that this radioactive isotope affords a reasonably efficacious means of radiation of leucemic cells without producing radiation sickness.

While numerous tracer studies have been carried out with the aid of radioactive phosphorus, the possibility must be considered that there may be some alterations in the absorption and retention of the isotope when given in larger amounts, because of the biological effect of the β radiation such as for instance, a change in cell permeability, which has been clearly established. Undoubtedly there are considerable variations in the amount of radioactive material absorbed in the different tissues because of variations in the amount of blood contained, in the degree of leucemic infiltration, and in the extent of necrosis of normal but highly radiosensitive cells, apart from the selective absorption of the tissue elements.

The author's study is based on autopsies in 10 leucemic patients performed one to thirty-five days following the last dose of radioactive phosphorus.

The deposition of radioactive phosphorus was greatest in those tissues that usually show a heavy infiltration of leucemic cells. The liver, spleen, kidneys, and bone marrow contained relatively large amounts. Slowly metabolizing tissues, as brain, fat, and cartilage, contained but little. The concentration in the bile was sometimes fairly high.

The distribution of p^{32} in human tissue is generally comparable with that obtained in rodents experimentally. JOSEPH K. NARAT, M.D.

MISCELLANEOUS

Warren, J. V., and Stead, E. A., Jr.: The Effect of the Accumulation of Blood in the Extremities on the Venous Pressure of Normal Subjects. *Am. J. M. Sc.*, 1943, 205: 501.

Pulmonary edema from cardiac failure develops whenever the right ventricle pumps more blood into

the pulmonary vessels than the left ventricle can pump out. Therefore, therapy is largely directed toward decreasing the output of the right ventricle. The venous return to the right ventricle may be decreased by quieting the patient with morphine, by phlebotomy, and by the application of venous tourniquets to the extremities. The beneficial effect of the accumulation of blood in the extremities by venous tourniquets presumably results from a decreased venous return to the right ventricle as the result of a decrease in venous pressure. Many physicians have believed that in certain patients the accumulation of blood in the extremities by means of tourniquets is as effective as phlebotomy in the treatment of left ventricular failure.

The author states the purpose of this study was to determine whether in normal subjects venous accumulation in the extremities produced a significant decrease in venous pressure. In 6 normal subjects, the average decrease in venous pressure in the external jugular vein produced by the application of venous tourniquets to the thighs was 53 mm. of water, the extremes reaching a plateau after from two to four minutes. After release of the tourniquets, the venous pressure rose rapidly, and reached the resting level in from thirty to sixty seconds. The application of venous tourniquets always produced a greater decrease in venous pressure in the external jugular than in the antecubital vein.

Accumulation of blood in the lower extremities by the application of venous tourniquets causes a significant lowering of the venous pressure in normal subjects. The fall in venous pressure is primarily produced by the increase in size of the venous bed in the extremities, although the slight decrease in plasma volume brought about by the high capillary pressure in the extremities may be a minor factor. If the venous bed in the extremities has already been distended by postural means or by a marked generalized increase in venous pressure, the application of tourniquets will produce little further increase in the size of the venous bed. If the legs are swollen tight with edema, the high tissue pressure will prevent the accumulation of large amounts of blood in the veins. Failure to recognize these limitations in the use of tourniquets accounts for the occasional report that venous tourniquets are ineffective in acute left ventricular failure. HERBERT F. THURSTON, M.D.

SURGICAL TECHNIQUE

WAR SURGERY

Symonds, C. P., and Russell, W. R.: Accidental Head Injuries. Prognosis in Service Patients. *Lancet*, Lond., 1943, 244: 7.

The type of head injury described in this article simulates that seen in civil life which consists of head injury due to accidents other than gunshot or bomb wounds. Patients of this type were divided into acute cases, those seen within three weeks of the accident, and chronic, those seen three weeks after the injury. The patients with acute conditions totalled 242, of which 215 returned to duty. Those with chronic conditions, totalling 718, generally had unsatisfactory results as 370 were unable to return to work.

An effort was made to classify the severity of the head injury on the basis of the duration of the post-traumatic amnesia. This method, while admittedly unsatisfactory, was considered by the authors as the best single criterion at present available. In determining the length of this period it is necessary to wait some little time after the patient has become conscious, for in many cases amnesia will persist for sometime after the conscious state of the patient returns.

The form of treatment given these patients followed a set of principles based upon the symptoms exhibited by the patient. All cases were at first confined to bed, but as soon as a patient had become symptom-free he was encouraged to sit up and gradually increase his activities. The rate of progress depended upon the symptoms of the individual case. Except in the mildest cases, lumbar-puncture was usually done in order to determine the presence or absence of blood in the fluid or any increase in pressure. No restriction was placed on posture in bed, and sedation was used as little as possible.

Occupational therapy was employed as soon as the patient was willing to take it and regular physical exercises of a light type were begun as soon as the patient had been up for a day or two. The presence or absence of headache was considered the best guide as to the progress of any one patient.

In general, it was found that patients with a chronic head injury exhibited a relatively bad prognosis and that this prognosis depended more on the duration of post-traumatic amnesia than on the apparent severity of trauma.

J. GARROTT ALLEN, M.D.

Wilson, J. V., and Tunbridge, R. E.: Pathological Findings in a Series of Blast Injuries. *Lancet*, Lond., 1943, 244: 257.

The pathological findings in a series of 11 persons who died following the concussion incident to a bomb explosion are reported. These people were in a bomb shelter dug out of the rock on the island of Malta. This shelter had two entrances, and the bomb, probably of the 500 kgm. high explosive type, exploded just outside one of the entrances. The force of the explosion was so severe that portions of the concrete surrounding the other entrance were shattered. In none of the cases described were there any injuries considered adequate to cause death other than the blast. To be sure there were superficial burns and other slight injuries to the exterior of the body, but these were not sufficient in themselves to cause death. The authors believed that the following were definitely ruled out as a cause of death: poisoning by gaseous fumes, asphyxia, burns, fat embolism, and direct trauma. There were adults and children, ranging from one and one-half years to fifty-four years. Persons who showed severe external damage were excluded from the study.

All cases presented frothy bloodstained fluid in the trachea, larynx, mouth, and nose. In all there were extensive pulmonary hemorrhages, bilateral in extent. Six cases showed hemoperitoneum and congestion of the abdominal vessels, 3 showed mediastinal hemorrhage, and 1 presented a ruptured aorta.

While the pulmonary hemorrhages involved primarily the deeper portions of the lungs, they did extend to the pleural surfaces. The hemorrhagic areas did not have the feeling of true consolidation, and in all cases tested the lung tissue floated on water. In some areas, particularly when the hemorrhage involved the inferior margin, the lung had a leathery feel. The area of subpleural hemorrhage had no constant pattern; rib markings were constant and more marked in children; they sometimes appeared as dark linear shadows superimposed upon the widespread hemorrhagic areas. There were a few emphysematous bullae on the pleural surfaces but in no instances was there any marked effusion into the pleural or peritoneal cavity, nor were there any cases of pneumothorax.

The most characteristic feature of the microscopic anatomy of the lungs was the congestion of the alveolar capillaries even in those areas grossly free of hemorrhage. Many of the alveoli were distended with red cells and in a few instances with edema fluid. The alveolar epithelium was often found packed with red cells even when the alveolar spaces contained but few cells. In a few instances there was evidence of rupture of the alveolar epithelium and the formation of bullae, but this was not a prominent finding. The presence of alveoli filled with edema fluid alongside others containing red cells is difficult to explain. There was no evidence to suggest that alveoli immediately surrounding the larger bronchi were more seriously affected than the others. The general picture was the same in all cases with no essential difference in tissues taken from the central or the peripheral areas of hemorrhage, from the young or from the old, from patients dying immedi-

ately or from those dying eight hours after the incident.

Three views have been put forward to explain the method of production of the pulmonary lesions of blast injury:

1. The suction wave following blast leads to rupture of the alveolar capillaries (Logan 1939).
2. The sudden distension of the lungs with air causes rupture of the lung tissues (Barcroft 1939).
3. It is the traumatic effect of the blast wave upon the chest wall (Zuckerman 1940).

The authors believe that the latter is the case and that the lesions in human beings are in no way unusual and specific, but are lesions that one might expect to find if the body were struck by a violent force, namely, the percussion wave of a high explosive.

In the present series of cases the pulmonary hemorrhages were so extensive that it is conceivable that they may have caused death. In some cases, however, they were not sufficient to cause death and in these instances one is forced to fall back upon the possibility that death was due to some as yet ill understood cause. The possibilities include some reflex action on the vital centers and ventricular fibrillation following upon a blow on the chest.

JOHN W. EPTON, M.D.

McMullin, J. J. A.: Foreword to Symposium on Immersion-Blast Injuries.
Palma, J., and Uldall, J. J.: Immersion-Blast Injuries.
Pugh, H. L.: Surgical Report on Immersion-Blast Injuries.
Gates, R.: Roentgen Findings in Immersion-Blast Injuries.
Ecklund, A. M.: The Pathology of Immersion-Blast Injuries.
Hamlin, H.: Neurological Observations on Immersion-Blast Injuries. *U. S. Nav. M. Bull.*, 1943, 41: 1–26.

FOREWORD TO SYMPOSIUM ON IMMERSION-BLAST INJURIES

Immersion-blast injuries, the result of detonation of high explosives under water, differ from blast injuries sustained in air because of the operation of the principles of hydraulics. A blast wave is an excessively intense longitudinal sound wave, which, in water, travels four times as fast as in air. The critical distance from the center of detonation of a given charge of high explosives in the air is about 20 feet, while in water this critical distance is increased to at least 80 feet. Immersion blast results primarily in damage to the lungs and to the walls of certain loops of intestine. The severity of the damage depends upon the intensity and proximity of the blast. Intense explosive force may conceivably cause lethal pulmonary damage, or rupture the intestinal wall immediately and thereby cause a fatality shortly after injury. Post-mortem examinations consistently revealed hemorrhagic areas in the lungs, particularly in the lower lobes, but none of the casualties seen several days after injury could be ascribed to pulmonary damage. The type of intestinal perforation seen in the autopsies performed was ulcerous and did not conform to the usual appearance of primary intestinal laceration. No injury to the liver, spleen, or kidneys was observed. These organs are apparently protected anatomically. Intestinal vessels rupture and produce ecchymoses and hematomas in the walls of affected loops. Ileus occurs and subsequent increased intra-intestinal pressure may cause perforation or may prevent the sealing off of a primary perforation. Generalized peritonitis, abscess formation, and intestinal gangrene may follow.

The three practical questions concerning these injuries are: (1) How can water-blast injuries be eliminated or minimized? (2) How should the patients be treated? (3) What are the indications for surgery? The answer to the first question is protection of the anterior chest and the entire abdomen by a life jacket made of kapok or some other buoyant material. Men should be instructed to swim on their backs if the abdomen is not adequately protected. Treatment is predominately conservative in the majority of cases. Shock should be counteracted with adequate intake of fluids, electrolytes, and colloids. All medication, water, and nourishment by mouth are interdicted. Morphine is given for pain and restlessness. Intraintestinal pressure is reduced by continuous suction preferably with a Miller-Abbott tube. Sulfa drugs are administered intravenously and oxygen is supplied generously. Whole-blood transfusions are used if the patient is anemic or shows signs of intra-abdominal hemorrhage. Operation should not be advised unless there is a definite indication, such as recent perforation, gangrene of a segment of bowel, or abscess formation. These patients are poor operative risks and the least, the simplest, and the most expeditious technique is safest.

IMMERSION-BLAST INJURIES

Thirty-five cases of immersion-blast injuries admitted to the hospital five days after injury were presented. Their histories and physical findings were similar. The severity of their complaints depended upon the distance they were from the source of the explosion. In the more severely injured these distances varied from 100 to 150 feet. The relative position in the water at the time of the explosion was also a factor in the severity of symptoms, whether the patients were horizontal (prone or supine), or perpendicular (facing the blast or with their backs turned). All the men but 2 wore life jackets. In 1 patient who was swimming on his side at the time of the explosion the findings were mainly in his chest and abdomen on the submerged side. Various sensations were described by the victims, and many were unconscious or stunned. From ten to forty-five minutes after the explosion the ones facing the blast or swimming in the prone position began to experience abdominal symptoms varying from mild, fleeting cramps to severe continuous abdominal pain. Several vomited and developed diarrhea. At about the

same time practically all experienced a sense of thoracic compression. Many had hemoptysis lasting from twelve to twenty-four hours. The group that had their backs turned to the blast or who were swimming in the supine position had milder abdominal symptoms and their signs were mainly in the chest. The physical findings varied from slight to moderate dullness and diminished breath sounds, especially over the bases of the lungs. Later they developed rales and rhonchi. Abdominal signs varied from moderate generalized soreness and slight rigidity to marked distention and boardlike rigidity. In the severe cases diaphragmatic excursion was limited and peristaltic sounds were absent. Of the 35 patients, 16 were ambulatory and presented few signs and symptoms, but many had roentgenographic evidence of blast injury at the bases of both lungs. Several had pulmonary findings comparable to those of atmospheric blast injury. Two patients had red blood cells in the spinal fluid; 1 developed a definite personality change; and 1 showed a neuromuscular disturbance. Of 14 patients presenting signs of severe abdominal injury, 6 recovered completely without operation, 2 are recovering without surgical intervention, 2 are recovering after necessary surgical procedures, and 4 died.

SURGICAL REPORT ON IMMERSION-BLAST INJURIES

Surgical consultation was requested on 7 of the 35 patients. Two of these died within a few hours of transfer to the surgical service, the survival time being five and twelve days, respectively. Free air beneath the diaphragm was demonstrated in the first patient and multiple perforations of the small intestine with peritonitis of several days' standing was found post mortem. Autopsy in the second case revealed massive intra-abdominal hemorrhage and extensive hemorrhage in the entire cecum and ascending colon without evidence of intestinal perforation. There was severe contusion of the lungs. Another patient, who showed free subdiaphragmatic air and was critically ill recovered on symptomatic treatment. One patient developed a tender mass in the upper left abdomen which disappeared following the administration of an enema. Of the entire group, only 2 patients were operated upon. One of these developed signs of intestinal obstruction six days after admission. He was relieved by the use of the Miller-Abbott tube and prostigmine. After four weeks of apparent recovery he was seized with severe abdominal pain and lapsed into profound shock. A preoperative diagnosis of mesenteric thrombosis was made and intensive supportive treatment instituted to permit operative intervention. A volvulus of the first 40 cm. of jejunum was found. The gangrenous segment and its mesentery were resected and catheters were tied into the proximal and distal segments, respectively. The segments were fixed to the anterior abdominal wall. Postoperatively he was given jejunal feedings and supportive treatment for one week, at which time a secondary anastomosis was performed. Because of the limited length of the proximal segment, a Murphy button was used for the anastomosis. Except for a wound infection in the abdominal wall the postoperative course was satisfactory and ultimate complete recovery is anticipated. The other patient was operated upon for an abscess of the right upper quadrant. A large amount of foul-smelling pus and detritus was drained and a necrotic mass of omentum was delivered from the cavity. The wound was closed lightly with drainage and within a few days a fecal fistula developed. One week later a mass of tissue simulating a gangrenous segment of gut sloughed out of the wound. X-ray examination revealed a hepatic-flexure fistula but did not indicate the source of the necrotic mass.

ROENTGEN FINDINGS IN IMMERSION-BLAST INJURIES

Of the 35 patients whose chests were studied roentgenologically, only 5 had clear lung fields. The remaining 30 showed areas of increased density in one or both lobes, the areas being largely confined to the lower lobes. The most common finding was a fuzzy, linear zone of increased density situated just above the diaphragm laterally and in the costophrenic angle. In general, the zones of density were fainter and less sharply defined than the shadows seen in cases of bronchopneumonia and atelectasis. The cases showing more or less generalized changes in the lungs resembled reported cases of air blast of the lungs. Complications were few and rapid resolution of the densities was a striking feature in most cases.

Abdominal and gastrointestinal studies revealed gaseous distention of the small intestine with gas in the colon in all cases, indicating ileus rather than obstruction. In several cases there was evidence of fluid or exudate between the loops of distended intestine. The findings were essentially the same as those of peritonitis. Free gas was demonstrated in 2 of the cases studied with x-rays. Abnormal soft-tissue densities were seen in several cases, usually occupying most of one side of the abdomen. Numerous tiny bubbles of gas were seen within the areas of soft-tissue density in 3 cases, presumably from intestinal perforation. Gastrointestinal studies with the barium meal in 5 cases with recovery showed an abnormality in the mucosal pattern and walls of the small intestine in one, and a fecal fistula originating at the hepatic flexure in another. Illustrations of the various roentgen findings are presented.

THE PATHOLOGY OF IMMERSION-BLAST INJURIES

En route from the battle area to the hospital 26 patients with immersion-blast injuries had died and had been buried at sea. Of the 35 who reached the hospital, 4 came to autopsy. Whereas, in atmospheric blast injury the principal seat of trauma is in the thoracic cavity, in the 4 cases of immersion blast the predominant and urgent pathology was abdominal. In none was there external evidence of injury.

The pathological findings in each case are reported in detail with illustrations of specimens. In 3 cases there were intestinal perforations with peritonitis. There was a tendency for the most severe damage to be located in the ileocecal region. Serosanguinous fluid was present in the pleural cavities in all cases. In one case a subdural hematoma was found but in the others the brains were not abnormal. Microscopic examination of sections cut through the perforations indicated that forces acting from within the lumen of the intestine caused the perforations. Sections from the lungs showed quite uniform histological features with evidence of extensive hemorrhage into the alveoli and rupture of the alveolar walls. Inhalation of salt water and oil may alter the pulmonary changes in immersion-blast injuries. The absence of rupture of the liver, spleen, kidneys, and bladder is remarkable. Many factors enter into the variations of each case, such as, the amount of food and gas in the intestinal tract, the feces in the colon, and the position of the patient in the water and distance from the explosion.

NEUROLOGICAL OBSERVATIONS ON IMMERSION-BLAST INJURIES

Many of the victims of immersion blast had a history of unconsciousness, and in general their condition on hospital admission was that of clouded sensorium and diminished reflex activity. Headache had been noticed in most cases. Persistently abnormal findings were recorded in only 2 patients. Autopsy on 1 patient revealed a subdural hematoma which was probably the result of a direct blow rather than of blast. Neurological examination of this patient had been negative but no lumbar puncture had been done. Post-mortem examination of the spinal cords was not done and no microscopic sections were available. Lumbar punctures were done on 10 patients. In 3 instances there were subarachnoid red cells and slight elevation in the total protein for from four to six days after injury. Concussion of the leptomeninges of the cord presumably occurred despite the fact that life jackets were worn. One patient exhibited a personality change and another a persistent neuromuscular disorder. The neurological findings in 12 cases are tabulated.

JOHN L. LINDQUIST, M.D.

Loria, F. L.: Penetrating Gunshot Wounds of the Abdomen. *South. M. J.*, 36: 87.

Penetrating gunshot wounds of the abdomen are the gravest of all major emergencies involving this cavity. Although occasional reports of low mortality have given rise to optimism, ordinarily the death rate in these cases still fluctuates between 50 and 60 per cent. Penetrating gunshot wounds of the abdomen proved more serious than those of the chest at Pearl Harbor.

The present report representing the experience of Charity Hospital at New Orleans, during fifteen years prior to January, 1942, includes 478 cases admitted for treatment during this time; 324 negro victims and 154 white comprised the group. Four per cent of the injuries in the group were the result of suicidal intention, 10 per cent were accidental, and 86 per cent were due to homicidal acts.

The study of the degree of shock in these series showed that in 60 of the patients shock was absent and in this group there was a mortality of 15 per cent. Seventy-five of the patients demonstrated evidence of slight shock and in this group the mortality was 17 per cent. In 49 patients there was moderate shock and a mortality of 43 per cent, while in 139 patients shock was severe and the mortality was 88 per cent. In 155 cases the extent of shock was not determined, and the mortality was 59 per cent.

Three hundred sixty-nine of the entire group were explored and suffered a mortality of 49 per cent while 109 were not operated upon and in this group the mortality was 73 per cent. The nonoperative group was composed of patients moribund at the time of admission. The time interval between injury and operation was studied also, and there was no evidence that the mortality in those operated upon under six hours was any better than in the second group operated upon after six hours. The mortality, however, rapidly increased with the number of organs injured. Accordingly in 26 cases no organ or important structure was injured and the mortality rate was 4 per cent. Those in whom one organ was injured had a mortality rate of 35 per cent, while in the group with two organs injured the mortality was 66 per cent. The mortality was also influenced by the amount of blood lost.

In general there were two principal causes of death. These were shock and hemorrhage, and general peritonitis and septicemia. Together they accounted for 96.9 per cent of the fatalities.

J. GARROTT ALLEN, M.D.

Good, H. S.: Fifteen Days Adrift on a Raft. A Clinical Evaluation of 5 Survivors. *U. S. Nav. M. Bull.*, 1943, 41: 367.

Five survivors were rescued from a life boat and a raft after fifteen days of exposure. The average temperature of the water was 61 degrees and of the air 70 degrees. The sun was not severe, the weather being foggy 70 per cent of the time. The survivors were fully clothed during the fifteen days of exposure, and were very weak and had to be helped aboard the rescue ship.

Four of the 5 survivors were conscious and rational. All of the men had numerous superficial yellow pustules all over their bodies. Three of the men had areas of skin that were black from oil. These areas were in much better condition than the rest of the skin. The oil-stained skin was softer, more elastic, and did not have as much infection as the harder, dry skin on the survivors not immersed in oil. There was 1 case of severe aphthous stomatitis. The other 4 survivors showed a very parched condition of the mouth and throat. None showed evidence of submucous hemorrhages.

All suffered a great deal of pain in their feet. They were not able to sleep because of the burning pain in their feet. One of the men who had drunk considerable quantities of sea water the last two days on the raft developed markedly edematous feet in two days after being on abundant fluids. None of the other survivors developed edema at any time. All 4 survivors from the raft showed some muscle wasting. The 1 survivor from the boat had firm muscles and good tone. This man drank 2 cans of condensed milk a day for the first ten days.

All survivors agreed that drinking sea water makes one become more irrational than a person who abstains. All survivors had elevated temperatures ranging from 101° to 103° F. and pulses in the neighborhood of 120. Three days after the rescue the temperature and pulse were normal except in the survivor with the ulcerated mouth and the survivor with the ulcerated feet.

Two survivors suffered from severe constipation. Urinalyses were negative. Blood counts showed all of the survivors to have a moderate secondary anemia. They were not nauseated nor did they have abdominal pain at any time.

Petrolatum was applied to the extremities and seemed to give more relief than either cold cream or lanolin.

It was concluded that food and water should be put in small hermetically sealed cans for individual consumption. Also canned milk should be hermetically sealed and stored in many places on a raft or boat. Small amounts of fruit juices should be provided in hermetically sealed cans. Mixed concentrated vitamin tablets should be included in each ration. Two-quart cans of liquid petrolatum should be placed in each life boat to be applied externally to exposed areas, and it may be taken internally as a lubricant. The salt and water balance of the body plays a large role in the health of the shipwrecked individual. It seems reasonable that a small amount of salt water should be mixed with the fresh water to make up the daily rations.

RICHARD J. BENNETT, JR., M.D.

Muir, E. G.: Surgery in the Middle East. *Lancet*, Lond., 1943, 244: 1.

The major surgery in the Middle East is, as a rule, limited to three units—the surgical team or field surgical unit, the casualty clearing station, and the base hospital. The surgical team consists of a surgeon, anesthetist, and a varying number of nonprofessional personnel. The equipment carried for the surgical team is designed to allow it to function on its own for a limited period. Its theater of operation may be a lean-to tent fixed to the back of a truck, or a separate tent. Since this group generally functions fairly close to the front it is desirable to have the unit small in size and quite mobile. The surgeon is forced to confine himself to the very seriously wounded and to allow the less seriously wounded to be moved back to the base hospital or treated by the nonprofessional members of the team.

The author did not believe that under such conditions the practice of excision and primary suture of any wound was justified. Clean through-and-through bullet wounds were best left alone, apart from possibly the introduction of some sulfanilamide powder and the application of an antiseptic dressing. In larger wounds, necrotic tissue was removed and the wound provided with adequate drainage. Sulfanilamide packs were found to be very helpful. The intravenous administration of sulfonamides and the use of blood and plasma transfusions were frequently resorted to in this field of operation.

Still one of the greatest problems has been the lack of success in the treatment of penetrating wounds of the abdomen. From the author's experience and from his conversation with his colleagues he concludes that the operative survivals of penetrating wounds in the abdomen were probably less than between 20 and 30 per cent. The factor which most seriously contributed to this mortality rate was the prolonged period between the time of the injury and the surgical repair. The earliest abdominal operation which the author performed was done six and one-half hours after the patient had received the injury; the average length of time amounted to about fourteen hours.

The heat in this theater of war was excessive. Ether would boil when the cork was taken off the bottle, and since gas was not available, chloroform became a necessary anesthetic.

Wounds of the chest were fairly frequent. Some of the sucking wounds were closed by one or two through-and-through sutures. However, since such wounds very frequently became infected, the author favored the use of a temporary pack and appropriate surgical procedure was done at a more opportune moment. The after-treatment has been repeated aspiration, with or without air replacement, blood transfusion, and the administration of sulfapyridine. Most cases seem to have done well on conservative lines.

Compound fractures, with few exceptions, were treated by débridement and immobilization. Compound fractures of the femur remain as one of the more serious casualties. Most of the patients arrived at a hospital in a Thomas splint or extension strapping; cleansing of the wound had already been done. The author believes that wide incision of the wound should be carried out to insure adequate drainage. A sulfanilamide vaseline pack was placed in a wound of this type and a Kirschner's wire was placed through the tibial crest; then traction was applied with the patient in a plastic spica from waist to toes. After two or three weeks it was believed that the Thomas splint could be used to replace the plastic cast.

The sites of election for an amputation of the lower limb have almost been standardized, but when such an amputation should be performed is debatable. In warfare a wound of the lower limb requiring amputation is often twenty-four or more hours old before surgery becomes available. True guillotine

amputation at the site of election can only be justified if there is no other alternative. These amputations are seldom done; in most of the amputations performed in the forward area, flaps of some kind have been fashioned, held together with one or two sutures, perhaps over a sulfonamide-vaseline pack, or occasionally stitched back. Secondary suture has in many cases produced an excellent stump. Among the patients with amputations admitted to a base hospital the author has seldom seen an amputation stump of the lower limb which had completely healed by first intention.

The treatment of burns has undergone several changes since the start of warfare in this theater. The use of tanning methods has been largely abandoned. While many excellent results were obtained, many failures occurred, and when these methods fail it would have been far better if they had never been tried. They are, as a rule, unsuitable in the forward area unless optimum facilities are present and there is adequate time for careful cleansing. Tannic-acid jelly as a first-aid dressing has also failed to justify its continued use. The treatment with moist dressings has proved a failure for much the same reason, the author believes, that most of the surface and extensive burns received at the base hospital require treatment anew after two or four days. Cleansing, the use of a sulfonamide spray, and the application of vaseline bandages is the treatment the author preferred. The patient is then given a course of sulfanilamide by mouth, and a plasma drip is continued until the hemoglobin is reduced to 100 per cent. If the fever subsides and the dressings are not soaked with pus they are left on until they fall off. If secondary infection is present the dressings are sponged off in a warm saline bath every forty-eight hours and reapplied. J. GARROTT ALLEN, M.D.

Toman, A. J.: Lobelin in Asphyxia during Gunshot Surgery. *Am. J. Surg.*, 1943, 60: 270.

Asphyxia which results from shock requires the administration of a quick-acting respiratory stimulant.

In all cases of this type in which lobelin was administered, respirations became evident and normal within two or three seconds after intravenous injection.

One injection was sufficient in all cases and no further means of treatment, such as oxygen or artificial respiration, were necessary.

J. M. MORA, M.D.

Leech, B. C.: R.C.A.M.C. Anesthetic Experiences. Dieppe Raid Casualties, August 19-20, 1942. *Proc. R. Soc. M.*, Lond., 1943, 36: 207.

Two Canadian field ambulance units did splendid work in unloading the returning Canadian wounded and giving first aid at the docks. The patients were then loaded into Canadian ambulance convoys and taken to Canadian military hospitals, the nearest of which were from 22 to 40 miles inland. Two ambulance trains were used and carried patients from the south coast to an inland area. Of the casualties brought in, 65 per cent were found to be in need of immediate surgery requiring anesthesia.

A rough anatomical classification indicated that intracranial injuries constituted 1.5 per cent of those receiving immediate operation; intrathoracic 2.5 per cent; intra-abdominal 2 per cent; extremities with compound fractures 30 per cent, and multiple wounds, 62 per cent.

The time elapsing between trauma and the induction of anesthesia for surgery varied from twelve to fifty-eight hours, the average being thirty and one-half hours. Pre-operative shock was treated in 10 per cent of the cases, and of these only about 1 per cent were in serious shock or collapse. The ordering of preanesthetic medication was handled variously in different centers. Generally speaking, this was ordered by the ward medical officer in accordance with a routine previously established by the anesthetist, or was ordered after brief consultation with the anesthetist in special cases. Every anesthetist was fully aware of what premedication was given in each case and also of the time at which it was administered.

The emergency anesthetic agents were as follows: intravenous pentothal alone in 51.25 per cent; the same supplemented by nitrous-oxide-cyclopropane in 3.5 per cent; cyclopropane alone or with pentothal induction in 25.25 per cent; cyclopropane with ether in 2.75 per cent; open ether in 6.5 per cent; nitrous-oxide-oxygen plus ether in 1 per cent; procaine infiltration in 7.25 per cent; avertin and procaine field block (cranial) in 0.5 per cent; and a spinal anesthetic in 1.5 per cent. No harmful results were observed from the use of any "sulfa" drugs. The organization of surgical teams is discussed.

HAROLD C. OCHSNER, M.D.

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Melton, G.: Oxygen Therapy in Shock. *Lancet*, Lond., 1943, 244: 481.

The author's observations in a series of 31 cases of shock lend support to the view generally held that oxygen is of benefit, particularly in the more severe cases. Its effect in raising the blood pressure and improving the pulse, color, mental alertness, and well-being was noted. However, the author points out the fact that in severe cases oxygen can in no way replace more important methods of treatment, such as transfusions; it is to be regarded as a supplement to such treatment.

RAYMOND J. MCGANN, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Rabinowitch, I. M.: The Treatment of Phosphorus Burns. *Canad. M. Ass. J.*, 1943, 48: 291.

Phosphorus is a very efficient material for generating smoke screens and, because of its incendiary

properties, it is used in small arms incendiary bullets, in hand and rifle grenades, in artillery incendiary shells, in trench mortar bombs, and in bombs dropped from airplanes. A marked increase of phosphorus burns may, therefore, be expected as the war progresses.

When phosphorus comes into contact with skin and is allowed to burn, it produces almost immediately a grayish discoloration of the affected part. The initial pain is very severe. The phosphorus tends to imbed itself in the skin and the phosphorus acids produced tend to penetrate still deeper. However, blisters are rare. Phosphorus burns suppurate more than ordinary burns and heal slowly, in three or four weeks, or more. The danger of infection is thus correspondingly increased. The scars of the healed burns are usually found to be thin and atrophic.

White phosphorus is exceedingly poisonous. Even the vapors are dangerous.

FIRST-AID TREATMENT OF PHOSPHORUS BURNS

The treatment in the field is based upon the melting point of phosphorus and the fact that, while burning, phosphorus gives off phosphoric acid which itself causes the skin to burn. At the first-aid post, advantage is taken of the interaction between copper and phosphorus to form nonigniting black copper phosphide.

Briefly, the instructions to first-aid personnel are as follows:

In the field. Remove contaminated clothing at once (cut it off, if necessary) and flush the affected parts of the skin with warm (but not hot) water. Remove visible particles of phosphorus with a forceps while the skin is being flushed, taking care to remove every particle possible. Then apply a thick pad soaked in warm water.

If the burns are extensive, evacuate the casualty to a hospital at once. If the burns are small, evacuate the casualty to the nearest first-aid post.

At the first-aid post. Flush the affected parts with a warm solution of baking soda or washing soda, made by adding two tablespoonfuls of the soda to a pint of warm water. (Thorough alkalinization of the affected area neutralizes the phosphorus acids and thus renders them harmless.) Then wash the last traces of phosphorus away with a 1 per cent solution of copper sulfate and, with forceps, remove any dark-colored (blackened) particles noted. Finally, wash the affected parts with water containing a little of any antiseptic solution and apply a sterile dressing.

TREATMENT OF BURNS NEAR THE EYES

The simplest and safest procedure is to wash the parts well with warm water and apply a mask of lint soaked in sodium bicarbonate solution. The alkaline solution should be repeated every four hours. The alkaline treatment must be thorough and the dressing must not be allowed to become dry at any time.

TREATMENT OF INTERNAL INJURIES PRODUCED BY PHOSPHORUS-CONTAINING BULLETS

A careful search should be made for phosphorus diffusely implanted in tissues by looking for (a) fumes; (b) the characteristic odor of phosphorus, and (c) luminescence, and the affected parts should be washed thoroughly with warm water or, when permissible, warm solutions of sodium bicarbonate, to be followed, if necessary, with warm water. Advantage should also be taken of very weak solutions of copper sulfate for inactivation of the phosphorus.

ACUTE PHOSPHORUS POISONING

Under air-raid conditions consideration will have to be given to the possibility of accidental poisoning of food from flying fragments of phosphorus bombs. The vapors of white phosphorus are also poisonous and consideration must now be given to acute poisoning which may result from phosphorus-containing bullets.

The early signs and symptoms may appear almost at once. The usual interval is from two to six hours but in rare cases there may be a delay of from twelve to forty-eight hours. The symptoms consist of a burning sensation in the throat, severe pain in the epigastrium, intense thirst, eructations of gas with a distinctive garliclike odor, and vomiting, which may be very intense. The vomitus is dark green, black, or coffee-colored, and may be luminous in the dark. The breath may also be luminous on account of the adherence of small particles of phosphorus to the mucous membrane of the mouth. Purgation may or may not occur; it is not common, but it may be very severe, and the feces may also be luminous in the dark. The nervous and muscular debility is intense and death may occur from collapse or during a fit of convulsions within an hour. The fatal period may, however, be in two or three weeks, or more, but the average is about in five days.

Following the acute stage, which in most cases does not last longer than one or two days, there usually is an abatement of the signs and symptoms with a period of comparative comfort except for general malaise. This period may vary from a few days to a few weeks. The secondary phase may, however, follow the first almost immediately. It is usually ushered in by headache, great weakness, vomiting, and diarrhea, but the striking features at this stage are jaundice and a marked tendency toward hemorrhages in the skin and all mucous membranes, such as of the throat, bladder, uterus, and vagina. The abdomen becomes distended. The liver generally enlarges and becomes painful. The urine becomes scanty and is highly colored, and, in addition to bile pigments, albumin, blood, and casts, it may contain free fat globules. Although the pulse may be normal at first, it becomes progressively more rapid and weak as the prostration progresses. The respirations become rapid and shallow and death usually occurs in about five days. In cases of longer

duration, the liver may decrease in size toward the end, and death will occur from failure of liver function as in acute yellow atrophy. Though a rare occurrence, patients have been known to recover from this stage.

TREATMENT

Under no circumstances should oily or fatty materials, such as milk, be administered to alleviate the gastric irritation, as these aid absorption of the phosphorus.

Copper sulfate should not be used as an emetic, although some of it might convert the phosphorus into nonigniting copper phosphide. Aside from possibly adding to the irritation of the stomach, there is the danger that some of the copper sulfate may be absorbed because of destruction of the gastric mucosa.

Prompt lavage of the stomach with warm potassium permanganate solution (about 3 gr. to the pint) is the safest inactivating agent. It oxidizes the phosphorus, and the phosphorus acids produced are rendered harmless by dilution. The irrigation should be continued until the color of the returned liquid remains unchanged. Quarts of the solution may be required if the stomach contains food. After irrigation, the stomach should be washed well with warm water, and Epsom salts should be left in the stomach to promote catharsis. The dose should be repeated as often as required, to encourage elimination, for several days. If diarrhea has occurred, the bowels should be flushed with the warm dilute potassium-permaganate solution.

Diuresis should be encouraged by the repeated intravenous injection of a 5 per cent solution of glucose. This will tend to decrease the danger of hypoglycemia, and aid storage of glycogen in the liver which will reduce the degree of fatty degeneration.

When necessary, morphine should be given to relieve the pain. Sodium bicarbonate should be administered to combat the acidosis, which may be severe because of the phosphorous acids formed. A level teaspoonful (about 5 gm.) in a half glassful of water should be given every half hour until the urine becomes alkaline or until the person has received about 0.5 gr. per kilogram of body weight. If the alkali is not tolerated by mouth, a liter of a 3 per cent solution may be given intravenously. Further treatment is symptomatic.

ERNEST E. ARNHEIM, M.D.

Naide, M.: The Treatment of Leg Ulcers with Blood and Concentrated Plasma. *Am. J. M. Sc.*, 1943, 205: 489.

A simple method is described for the treatment of ischemic and varicose leg ulcers with the patient's own blood or with concentrated blood. After the ulcer was gently cleaned with hydrogen peroxide and mopped with sterile gauze, drops of blood drawn from the patient's vein were smeared or spread over the ulcer and allowed to clot solidly, and a sterile dressing was applied. For complete healing to take place, from 1 to 20 applications of blood were necessary.

Even more effective was dried plasma diluted with only one-quarter of the amount of distilled water necessary to obtain the normal concentration of human plasma.

Of 15 ulcers refractory to other treatment, 9 were healed, 2 were improved, and 4 failed to heal. Pain was rapidly relieved and the local inflammatory reaction subsided as a result of this treatment.

WALTER H. NADLER, M.D.

McClean, D., Rogers, H. J., and Williams, B. W.: Early Diagnosis of Wound Infection, with Special Reference to Gas Gangrene. *Lancet*, Lond., 1943, 244: 355.

Organisms of the gas-gangrene group, staphylococci, streptococci, and pneumococci, produce, in addition to their toxins, substances which cause an immediate increase in the permeability of the connective tissues. These substances exhibit a remarkable mucolytic activity, characterized by a rapid fall in the viscosity of the mucopolysaccharide known as hyaluronic acid, which is widely distributed in connective tissue. The enzymes are therefore called "hyaluronidases." Another enzyme which is present in the toxins of clostridium welchii and clostridium oedematiens is "lecithinase," which hydrolyzes lecithin. McClean and his coworkers have explored the possibility of detecting these enzymes which are produced by bacteria in wound exudates, with the hope of detecting the invasion by the organisms "at a stage when the infection cannot be recognized by clinical or ordinary bacteriological examination."

With the aid of guinea pigs, in which clostridial infections were produced by intramuscular injections, the authors first set out to determine how early in an infection these enzymes could be detected in the wound exudate or edema fluid, the distribution of these substances in the body fluids, and their correlation with the progress of infection. The organisms used were the clostridium welchii, clostridium septicum, and clostridium oedematiens. The hyaluronidase present in the samples was estimated either by its viscosity-reducing activity, or by the mucin clot-prevention test. The techniques for these two methods of detection of enzymes are presented in full. Methods of diagnosing the bacterial source of the enzymes by means of specific neutralization tests with antisera are also described.

If the infecting strains were capable of producing hyaluronidase, the enzyme could be detected in the edema fluid as soon as the infection was sufficiently advanced to produce enough fluid for examination. Lecithinase could be detected just as early with clostridium-welchii infection. With clostridium oedematiens infections, lecithinase was detectable only in small quantities late in the infection. The relation between the time of the appearance of organisms in the stained smear and the detection of enzymes

in the tissue fluids varied greatly. No actual data other than that given here are presented. Neither hyaluronidase nor lecithinase could be detected in the urine at any stage of the infections. Neither of the enzymes was ever detected in the circulating blood.

Eleven of 12 strains of clostridium welchii which were capable of producing clinical gas gangrene produced hyaluronidase when cultivated in media containing hyaluronic acid. Twenty other strains derived from various sources gave negative hyaluronidase reactions. All of the clostridium-septicum strains which were examined produced this enzyme. With the clostridium oedematiens, however, less than one-half the strains produced hyaluronidase, and there was no correlation with the incidence of gas gangrene due to the presence of this organism. The lecithinase produced by the clostridium oedematiens is of such low potency in the tissue fluids that it is not of diagnostic significance.

The authors emphasize the fact that the results obtained have been from experiments on animals with pure cultures, and that they have had no experience with clinical or experimental wounds contaminated with mixed bacterial flora, or infected with them. They believe, however, that the results warrant clinical trial.

In England, Weed, Minton, and Carter showed that the lecithinase reaction given by the clostridium-welchii toxin is not specific, and that it may be produced by the culture filtrates from common aerobes, and neutralized by various antitoxins. In answer to this, McClean appends the following footnote to his article: "The conclusions reached by Weed *et al*, seem to be due, in part at least, to their failure to allow for the activating action of calcium on the toxin, or to use buffered solutions in their system when working with undiluted reagents. The non-specific neutralization is explained by the excessive doses of antitoxin employed."

EDWIN J. PULASKI, M.D.

Beath, T.: The Suppression of Infection in Recent Wounds by the Use of Antiseptics. *Surgery*, 1943, 13: 667.

An effective antiseptic should possess the following capabilities:

1. In the strength used, it should kill bacteria if diluted at least two to four times more.

2. It should retain most of its germicidal ability in the presence of serum, blood, and crushed tissue, as well as of miscellaneous dirt.

3. The essential chemical should not react with the tissue juices or the blood and thereby be rendered inert.

4. It should not be a protein coagulant like phenol because on application a scum of coagulum might bridge over microscopic pockets and prevent the deeper penetration of the antiseptic.

5. It should interfere to a minimum with the power of the leucocytes and tissues of the blood to deal with organisms not killed by the antiseptic.

6. It would be desirable if the antiseptic could cross cell membranes and kill organisms which had somewhat invaded the tissues. It seems probable that no antiseptic exerts this power to a useful degree.

7. It should be nonselective toward various bacteria. All the antiseptics to be considered are fairly nonselective, but the coal-tar derivatives, dettol and amphyl, similarly to phenol, show minimum selectivity.

8. The product should be sufficiently inexpensive that one will feel no hesitation in using as much as desired.

9. It should be of proved clinical value.

The following antiseptics were investigated: 1 per cent aqueous iodine (Lugol's solution diluted 5 times); 5 per cent dettol (Dett), ½ per cent amphyl, 1/500 metaphen, 1/3,000 furmerane, 1/1,000 zephiran, 1/1,000 merthiolate, and 1/1,000 proflavine (acriflavine and 2:7 diaminoacridine hydrochloride). The germicidal power is represented in the order named relative to further dilution capability of killing bacteria. It is probable that none kills spores in the time it could be used for the treatment of a wound.

The available data make it impossible to place furmerane, zephiran, metaphen, and merthiolate with exactness.

Iodine 1 per cent (Lugol's solution diluted 5 times) is a powerful germicide in an aqueous medium and can kill bacteria if diluted about fifty times. However, it combines rather freely with almost any organic material and is largely inactivated by blood. It is not likely to be a useful antiseptic.

Merthiolate, metaphen, and furmerane are organic mercurials, and when diluted from five to ten times will kill staphylococcus aureus in ten minutes. However, the mercurials fall down seriously in other ways. They are largely inactivated by the presence of blood and serum, and appear to be highly toxic to tissues and especially to leucocytes.

Zephiran is a nonmercurial antiseptic of somewhat greater germicidal power than merthiolate and metaphen when organic material is absent. It appears to be subject to the same disadvantages as the mercurials.

Dettol 5 per cent (Dett) has strong germicidal power (i.e., somewhat greater than the mercurials), and this is only moderately decreased by the presence of large amounts of organic matter. It does not precipitate proteins. It is almost wholly nontoxic to fixed tissues but is probably toxic to leucocytes. A wound can be soaked for an hour without gross damage to the tissue. The material is a solution of a synthetically modified cresol.

Amphyl ½ per cent is a product which is somewhat similar to dettol but has an added ingredient. It is recommended by the manufacturer that it be used in ½ per cent strength, and this has less reserve germicidal power than 5 per cent dettol.

Acridines used in 1/1,000 solution are slow but sure germicides with an ability about equal to that

of the mercurials, to kill organisms on further dilution if given time for their action. They are bacteriostatic in much weaker dilutions than are necessary for quick bactericidal action.

Proflavine and 2:7 diaminoacridine appear to be no more toxic to tissue than normal saline solution, while acriflavine is somewhat toxic. Weak but bactericidal strengths interfere to a minimum degree with the activity of the leucocytes.

The evaluation of these antiseptics was obtained by their clinical application to wounds of the hand. The completed test consisted in soaking wounded hands in the antiseptic for three-fourths of an hour with the precautions that gross dirt and blood clot were removed and the antiseptic reached all parts of the wound. The wound was washed completely free of blood clot and macroscopic dirt with a sterilized brush and the antiseptic solution. The part was then soaked for forty-five minutes, after which the wound was sutured. No débridement was done except where obviously nonviable tissue existed.

STEPHEN A. ZIEMAN, M.D.

McIlwain, H., and Hawking, F.: Chemotherapy by Blocking Bacterial Nutrients; Antistreptococcal Activity of Pantoyltaurine. *Lancet*, Lond., 1943, 244: 449.

Sulfanilamide in therapeutically successful doses may or may not be inhibitory in vitro, because of the presence of coincident concentrations of antagonists such as p-aminobenzoate. P-aminobenzoate, however, is more than an antagonist, since it is a substance which is essential to animals and to bacteria. The action of sulfanilamide depends on its preventing the micro-organisms use of p-aminobenzoate, apparently by virtue of its structural similarity to p-aminobenzoate.

Another substance essential to the growth of many pathogenic micro-organisms, is pantothenate. This substance is present in the tissues and in the blood of animals. McIlwain examined several compounds structurally related to pantothenate, and found that pantoyltaurine was the most actively antibacterial in vitro, as it prevented the growth of hemolytic streptococci when present in concentrations 200 times as great as those of the coincident pantothenate. Next, the blood levels of pantothenate were determined in different animals. Knowing the ratio of pantoyltaurine to pantothenic acid which is necessary to secure inhibition of the growth of hemolytic streptococci in vitro, the dosage of pantoyltaurine was then established (in rats) which would produce the inhibitory concentration of the drug in the animals over a period of time. Doses giving this level saved the animals, while smaller doses did not. Mice, in which the blood level of pantothenate was much higher than that of the rat or man, were not protected. The validity of this deduction of in-vivo action from in-vitro experiments was confirmed by artificially raising the blood-pantothenate of rats, when the previously effective dosage of pantoyltaurine became ineffective.

Eleven strains of the sulfonamide-resistant hemolytic streptococcus and some strains of the corynebacterium Diphtheriae were found sensitive to pantoyltaurine, though the staphylococcus bacillus coli, and bacillus proteus were not affected. There may be possible practical application to human therapy of this agent, but, the authors stated, the main value of this work lies in its description of new methods for the discovery of chemotherapeutic compounds.

EDWIN J. PULASKI, M.D.

Strakosch, E. A., and Clark, W. G.: Studies on the Penetration of Sulfonamides into the Skin. Penetration of Sulfonamides from Various Ointment Bases into the Intact Skin of Guinea Pigs; and a New Method of Analysis of Tissue Sulfonamides. *Am. J. M. Sc.*, 1943, 205: 518.

The rate of penetration of sulfanilamide into the intact skin of guinea pigs from 4 typical water-in-oil and 3 oil-in-water emulsion ointment bases has been determined by direct chemical analysis of skin biopsies with respect to time and concentration of sulfanilamide. There is no correlation between the penetration of sulfanilamide and the type of ointment base, at least in regard to whether the base is of the water-in-oil or oil-in-water emulsion type.

An increase of the concentration of sulfanilamide in ointment bases above 1 per cent has little effect on tissue levels of sulfanilamide reached, but an increase of the time of application of sulfanilamide consistently increased the tissue levels reached. Preliminary human experiments indicate that the results of the animal experiments may be justifiably extended to man.

A new method of tissue sulfanilamide analysis which permits large numbers of analyses to be made in a relatively short time is described.

SAMUEL KAHN, M.D.

Holder, H. G., and MacKay, E. M.: Carbamide-Sulfonamide Mixtures in Wound Therapy. *Surgery*, 1943, 13: 677.

The principle of carbamide action is that of a strong peptonizing and lytic agent for devitalized tissues. Carbamide action rids the wound of necrotic tissue by a process of chemical débridement. The action in markedly increasing the rate of healing of infected wounds is on the basis of ridding the wound of deterrents to normal healing rather than by direct bactericidal action. Bacteriostasis results from removing the substances producing bacterial growth and multiplication. Further, this is accomplished without great detriment to the normal physiological processes of wound repair and without material irritation or damage to the normal tissue cells. Outstanding as the results have been in the limited field of infected wound therapy, the applicability of carbamide in all phases of wound therapy has become much greater since its combination in topical application with the sulfonamide drugs.

The highly selective action of sulfonamides on the bacterial metabolism is evidenced by bacteriostasis

in the presence of concentrations of these compounds as low as 1 mgm. per cent. When implanted directly into wounds, these substances, like carbamide, show little demonstrable injury to normal tissue cells, or interference with the mechanism of phagocytosis and ultimate tissue repair. The efficacy of the topical use of these compounds in bacteriostasis has been shown to be directly proportional to (1) concentration of the sulfonamide inhibitors, (2) solubility and diffusibility, i.e., local concentration of the drugs, and (3) the degree of active cellular defense within the wound.

That the action of the sulfonamides is enhanced by the addition of carbamide is demonstrated as follows:

1. *In vitro* experiments have shown that ten times as much sulfanilamide alone is necessary to prevent the growth of a strain of escherichia coli as the amount of sulfanilamide used with 5 per cent carbamide. In this concentration, the carbamide alone is not particularly bacteriostatic. Similar results were obtained with a strain of staphylococcus aureus and sulfathiazole.

2. Carbamide increased the solubility of the sulfonamide drugs and prevented the usual caking of the relatively insoluble sulfa drugs with its attendant foreign-body reaction and interference with the reparative healing process.

3. The degree of active cellular defense within the wound is aided by carbamide in that this substance sequesters and removes necrotic tissue which is rich in bacterial contamination.

4. Carbamide may retard, however, the rate of epithelization in contaminated or infected wounds, but this is of little consequence as epithelial repair is not desired at the time it is used. As soon as the wound is covered with clean granulation tissue, treatment with this mixture will have been discontinued.

The clinical application of carbamide-sulfonamide mixtures has been most satisfactorily employed in first aid. When sprinkled over a fresh wound, the mixture (C.S.M.) tends to inhibit the growth of bacteria and chemically débride devitalized tissue. Formal surgery may be safely delayed long after twelve hours have elapsed. Many contaminated (not infected) wounds may be closed by primary suture without drainage after a careful débridement. Primary healing has been obtained.

Wounds in which tissue loss prevents primary closure are treated by the daily application of C.S.M. after suitable surgery including adequate débridement. This is immediately productive of clean, healthy, rapidly growing granulation tissue which permits early successful skin grafting and the attendant reduction of disability from scar-tissue contraction, as well as improvement in the final cosmetic result.

Should an infected wound result because of the impossibility of suitable surgery or any other cause, treatment with C.S.M. yields even better results than the very excellent ones obtained with carbamide (urea) alone. The mixtures are particularly useful in the closed plaster method of treating burns.

STEPHEN A. ZIEMAN, M.D.

Florey, M. E., and Florey, H. W.: General and Local Administration of Penicillin. *Lancet*, Lond., 1943, 244: 387.

Methods of using penicillin for the cure of infections by both general and local administration were studied. Fifteen cases of serious illness were treated with penicillin given by mouth or by intravenous or intramuscular injection, including 10 of staphylococcal infection and 1 of a sulfonamide-resistant streptococcal meningitis. All 10 of the patients with a staphylococcal condition and the patient with streptococcal meningitis recovered.

From this series it was clear that a generalized staphylococcal infection can be cured by penicillin, and that local lesions heal during its parenteral administration. Particularly striking was the healing of the bony lesions. Administration by the intramuscular route and at three-hourly intervals is the most practicable method of using the drug. To regulate the dose so that the blood constantly contains at least enough penicillin to inhibit the growth of the infectious organism requires about 15,000 Oxford units, but this varies from case to case. In assessing progress, the decrease of pain, improvement in appetite, and the sense of well-being are often more important than the temperature chart. X-ray examination shows increasing rarefaction of the affected bones during treatment although the infection is being overcome. No toxic symptoms due to the drug have been observed.

Local penicillin treatment was used in 172 infections of the eye and mastoid process, chronic wound sinuses, and miscellaneous local septic conditions. In most cases, after adequate treatment, staphylococci and streptococci were eliminated with subsequent healing.

While the supplies of penicillin permit the treatment of but few cases by general administration, the uses of local application are being further explored.

WALTER H. NADLER, M.D.

ANESTHESIA

Beecher, H. K.: Anesthesia for Seriously Wounded Patients. *J. Am. M. Ass.*, 1943, 121: 899.

The author discusses the considerations which determine acceptability or unsuitability of the common anesthetic agents for use in the seriously wounded. Several significant questions raised are:

1. Is any agent better than ether for general surgery under field conditions?

2. Does spinal anesthesia merit consideration for the seriously wounded, or for the person in shock or impending shock?

3. How much of the anesthesia load can the intravenous barbiturates carry in military surgery?

4. Does the value of cyclopropane justify the great effort to make it available in military hospitals?

5. Can anesthetic agents be used as therapeutic tools to delay or prevent shock?

Ether is the best all-around single anesthetic agent for major surgery and excells other inhalation agents in several points. Its great potency allows an adequate oxygen supply; good muscular relaxation is provided; a great factor of safety is present; tolerance of even the impaired circulatory system is well established, and a man in shock appears to tolerate ether far better than animals. The undesirable features are: a tendency toward acidemia, inflammability and explosiveness, and possibly irritation of the mucous membrane of the respiratory tract.

Divinyl ether is not satisfactory because a closed rebreathing apparatus is usually necessary and also because of its tendency to cause laryngeal spasm, profuse salivation, muscular twitchings, convulsions, and liver damage.

The only good reason for employing chloroform is its lack of inflammability. It can be easily administered and easily transported, and it will provide good muscular relaxation with a relatively low concentration in the inspired air. However, the undesirable factors seem to outweigh the desirable ones. These are the production of death through ventricular fibrillation, central necrosis of the liver, and destruction of the kidney tubules. Chloroform has a profoundly depressing effect on the circulation. It is interesting to note that naval officers have decided that chloroform is indispensable.

Ethyl chloride is easily transportable and adequate for brief general anesthesia, but it has the same general drawbacks as chloroform. In addition, it is inflammable.

Nitrous oxide, ethylene, and cyclopropane will probably have little or no usefulness at military fronts because they all require the use and transport of steel cylinders, cumbersome apparatus, and compressed oxygen for their successful employment. Nitrous oxide and ethylene do not provide good muscular relaxation. Nitrous oxide is not inflammable or explosive, while both ethylene and cyclopropane are explosive. Cyclopropane produces death apparently from ventricular fibrillation in a relatively high number of cases. Experiments indicate that the circulatory system of animals in shock or approaching shock tolerates cyclopropane better than other inhalation agents. This has not been adequately studied in man. Patients in shock or approaching shock for whom immediate operation is needed should receive ethylene or cyclopropane.

Intravenous barbiturates (evipal, pentothal, sodium) are poorly tolerated by bad risk cases. These drugs are hazardous because they produce a loss of sensitiveness of the respiratory center. They are chiefly useful for producing general anesthesia for short procedures on robust young persons. Spinal anesthesia is poorly tolerated by the wounded patient. An analysis of 2 series of perforated-ulcer cases at Massachusetts General Hospital indicated that serious depression of the blood pressure was twice as great with spinal anesthesia as with ether.

The experience of the English indicates that local anesthesia is poorly tolerated by severely wounded but conscious patients. This is due apparently to the moderate discomfort occasionally associated with the anesthetic plus the psychological injury. The harmful effects can be minimized by the use of epinephrine hydrochloride in the anesthetic solution and by the worker bearing in mind that toxicity from absorption increases in geometrical progression.

Local anesthesia is always to be considered when a noninflammatory, nonexplosive agent is needed. It is best restricted to rather phlegmatic or apathetic patients and is rarely adequate for major procedures.

JOHN A. GIUS, M.D.

Haworth, J., and Duff, A.: Trichlorethylene Anesthesia. *Brit. M. J.*, 1943, 1: 381.

In their experience with 306 cases, the authors have investigated such various points as could be conveniently done in ordinary hospital practice, and have offered their observations. The technique of administration used was either the open, or partial rebreathing from a gas machine with a nitrous-oxide flow of from 3 to 4 liters per minute and an oxygen flow of from 1½ to 2 liters per minute, the trichlorethylene being placed in the chloroform bottle. Surgical anesthesia was induced in from seven to eleven minutes and maintained on a consumption of 1 drachm for five minutes during short anesthesia or 1 oz. per hour for prolonged administration.

Fifteen per cent of the cases showed some struggling during the second stage. Relaxation was much less than that with chloroform, ether, or gas-ether anesthesia and in 28 per cent of the cases the depth of anesthesia could not be pushed beyond plane one of stage three. The action of trichlorethylene resembles that of chloroform. Primary syncope is a danger. Overdosage from presenting too high a concentration of the vapor is not as likely as it is with chloroform because of the limited solubility of the drug in body fluids. Increased respiration was troublesome in many cases, the rate being above 40 in a large number. There was practically no change in the blood-pressure observations. Trichlorethylene seemed to be indicated whenever a noninflammable anesthetic was required and as an adjuvant to gas-oxygen anesthesia when ether was contraindicated.

MARY KARP, M.D.

Gordon, R. A., and Shackleton, R. P. W.: Trichlorethylene in Plastic Surgery. *Brit. M. J.*, 1943, 1: 380.

The advantages of trichlorethylene anesthesia as listed from previous reports were (1) adequate analgesia and light planes of anesthesia; (2) no increase in bleeding due to the anesthetic agent; (3) minimal irritation of the respiratory tract; (4) freedom from postanesthesia vomiting; and (5) freedom from explosive hazard.

Because of these advantages, the authors decided to test the practicability of the drug. They were led to abandon its use after 100 cases.

The cases chosen were good risks, with the exception of 13 which were fair risks. Omnopon (gr. ⅓) and scopolamine (gr. 1/150) were given three-quarters of an hour or an hour before surgery. All patients except 1 were anesthetized with 5 per cent sodium pentothal given intravenously. A great majority of the cases, 65, had trichlorethylene as the additional agent. Others were given nitrous oxide and trichlorethylene. The average amount of trichlorethylene used was 5.5 cc. per hour of anesthesia, and 7.4 cc. per patient. Induction with trichlorethylene plus oxygen alone following pentothal was prolonged and often the robust patient recovered from his dose of pentothal rapidly enough to provide some excitement in the second stage. In all instances, the closed-system circle type, carbon-dioxide absorption technique was used. Seventy-six per cent of the cases were intubated by means of a Magill endotracheal tube. Respirations were increased in rate (from 26 to 80) in 16 patients and decreased in respiratory excursion. A bradycardia was the most constant effect on the cardiovascular system. Irregularities existed in 19 cases. These irregularities appeared to be due to extrasystoles. The blood pressure remained within normal limits, although it was very labile in those patients with irregularities. The recovery period averaged thirty-five minutes, the longest being two hours.

Complications were few; 16 per cent of the patients vomited postoperatively but none had persistent vomiting. There was 1 instance of postoperative pulmonary atelectasis and 1 of exacerbation of a chronic bronchitis.

The authors believe that the advantages of trichlorethylene (trilene) for plastic surgery far outweigh its disadvantages. However, the definite action on the conduction mechanism of the heart as well as the direct irritant or sensitizing effect on the myocardium requires further elucidation before trichlorethylene should be accepted as an anesthetic agent for general use. MARY KARP, M.D.

Weinstein, M. L., and Light, G. A.: Basal Anesthesia with Pentothal Sodium. The Use of Pentothal Sodium Rectally as a Basal Anesthetic, Based on Experience with 1,500 Cases. Spinal Anesthesia with Rectal Pentothal Sodium Basal Narcosis. *Current Res. Anesth.*, 1943, 22: 68.

Pentothal sodium is the newest of the ultra-short-acting barbiturates and is a sulfur derivative of pentobarbital sodium. It has been used quite successfully by many as an intravenous anesthetic. It is unquestionably the safest barbiturate we now have. The authors have had over 1,500 cases in which this drug was given by rectum, with no deaths or serious complications which could be attributed to the anesthetic. Of these, approximately 50 per cent were abdominal cases with involvement of the gall bladder, appendix, and the intestines; 25 per cent required gynecological procedures on the uterus and adnexa, and 25 per cent required miscellaneous procedures, including operations on the genito-urinary tract, thyroidectomies, mastectomies, bone surgery, and other procedures. Approximately 3 per cent of the 1,500 cases were children ranging in age from six months to fifteen years.

In most of the cases, the blood pressure remained stationary or slightly above the original reading, the respiratory rate was not appreciably affected, and no cyanosis occurred. There is no prolonged sleep as with avertin or evipal. Elimination of the drug apparently is more rapid than elimination of any other barbiturate since it is completely destroyed in the body and the breakdown products are unknown, none having been found in the urine.

Pentothal sodium is used rectally as a routine basal anesthetic, supplemented with ethylene, cyclopropane, ether, nitrous oxide, local or spinal anesthesia, or the intravenous use of pentothal sodium. A reduction of from 25 to 50 per cent is afforded in the amount of supplemental anesthetics necessary to relax patients for abdominal operations. One reason is the absence of the excitement stage, and another the apparent synergistic effect of the combined use of rectal pentothal sodium with nitrous oxide, cyclopropane, or ethylene. The necessity for ether has almost been completely eliminated since pentothal sodium is used as a basal anesthetic. Pentothal sodium given rectally in combination with a spinal anesthetic is ideal in all procedures such as resections of the stomach, duodenum, jejunum, ileum, and colon; kidney surgery; pelvic operations; and many other types of operations. Ordinarily oxygen is unnecessary, but in desperate cases that are poor surgical risks and in patients with upper respiratory, pulmonary, or cardiac complications, pentothal sodium given rectally as the basal anesthetic, supplemented with a local or spinal anesthetic and combined with oxygen inhalation is hard to surpass.

When spinal anesthesia was used, the blood pressure remained at the normal level or was slightly increased in a far higher percentage of cases when the spinal anesthetic was preceded by the rectal administration of pentothal sodium than when the spinal anesthetic was used with any other preanesthetic medication.

Rectal administration of pentothal sodium combined with local anesthesia with 1 per cent procaine has been used in 100 cases for removing tumor masses as well as for ligation of the saphenous vein.

In those cases requiring a very short period of anesthesia, as for local radium insertion, cystoscopy with or without bladder fulguration, curettement, reduction of fractures and dislocations, removal of vaginal and rectal polyps, biopsy procedure, opening of abscesses, spinal puncture with or without lipiodol studies, and similar minor operations, rectal pentothal-sodium basal anesthesia is sufficient and no additional anesthesia is required. Many such procedures have been done repeatedly in the same individual.

The elasticity of pentothal sodium is evidenced by recent experience with a number of operative pro-

cedures in which the rectal administration of pentothal sodium was used for basal anesthesia together with its intravenous administration for the supplementary anesthesia. This combination proved very satisfactory and required for the supplementary anesthesia a smaller amount of pentothal sodium solution for intravenous injection than is ordinarily given with other basal anesthetics, such as narcotics and other barbiturates.

Pentothal sodium may also be used rectally as a sedative in obstetrics to replace chloral and bromides, ether-in-oil, and other drugs such as opium and the barbiturates of the slower-acting groups. Pentothal sodium has been used rectally in the obstetrical department of the Chicago Memorial Hospital in at least 30 cases, with no ill effects on the baby, no cessation of labor pains, no delirium, but with prompt sedation followed by moderately rapid dilatation of the cervix. The drug is destroyed quite rapidly so that repeated instillations may be given. The recommended dose in obstetrics is from about one-half to two-thirds that for surgical cases, and this may be repeated as necessary.

For children pentothal sodium given by rectum has proved the ideal premedicant for all types of surgery, and afforded all the advantages obtained in adults. The authors have had among children over 30 tonsil and adenoid cases, about 15 appendectomies, and a small number of fracture cases in which pentothal sodium was given by rectum for basal anesthesia with fine results.

METHOD AND DOSAGE, RECTAL PENTOTHAL SODIUM

No opiates or other barbiturates are given in combination with pentothal sodium given by rectum; it is used alone. No preliminary enema is required for the rectal administration; however, if an enema is necessary in preparation for operation the authors use one of tap water or normal saline solution several hours before operation; soapsuds in the enema lessen the effect of the pentothal sodium.

The required amount of the drug is dissolved in ½ or 1 oz. of distilled water, and is instilled into the rectum by syringe through a catheter or by gravity with a funnel. This is done about fifteen minutes before the patient is moved to the operating room.

The dosage rule is 1 gm. or 15 gr., for every 50 lb. of body weight. The dosage table given has been found convenient. Atropine sulfate (gr. 1/150) hypodermically, or (gr. 1/100) by mouth, is given one-half hour before operation. Occasionally patients, especially those who have been receiving barbiturates over a period of time, are merely stuporous but not unconscious when they are brought to the operating room. They are relatively insensible to external stimuli and on the administration of inhalation anesthetics the excitement stage of anesthesia is absent.

For nervous patients, children, and bowel and rectal cases, the amount of distilled water for administering the pentothal sodium rectally may be as little as 15 cc.

For asthenic, overweight, anemic, and senile patients, and for patients in shock, the dosage is reduced 10 per cent. The dosage for children is the same as for adults, with even a slight increase being permissible. For obstetrical cases the recommended dose is from one-half to two-thirds of that for surgical cases.

DOSAGE TABLE

Weight in pounds	Pentothal sodium in grams
45–60	1.0
60–75	1.5
80–95	1.75
100–115	2.0
120–135	2.5
135–150	3.0
150–175	3.5

Within from fifteen to twenty minutes after the rectal administration of pentothal sodium, the patient is asleep or stuporous. The average duration of anesthesia is from one to two hours. There is a smooth slow return to normal during the awakening period, which averages from one to two hours, with a minimum amount of vomiting or nausea, which minimizes the amount of analgesic or sedative necessary in this period. There is no excitement during either the induction of or recovery from anesthesia with pentothal sodium except the ordinary restlessness which follows the average operation.

It has been unnecessary to resort to the use of antidotes, but for the treatment of overdosage of pentothal sodium the authors recommend first, oxygen; second, metrazol (given intravenously); and third, picrotoxin. For respiratory failure, the use of a resuscitator with 100 per cent oxygen is recommended. When stronger drugs are employed as basal anesthetics, overdosage is not uncommon, but this is not the case with pentothal sodium, which seems to have a greater margin of safety.

CONTRAINDICATIONS AND CAUTION

The authors have encountered very few patients to whom they hesitate to administer pentothal sodium. However, they would consider the following as contraindications to its use: (1) severe involvement of the trachea, edema of the glottis or mediastinum, or any other condition in which the respiration is embarrassed to any great degree; (2) any condition in which there is dangerous heart impairment with decompensation; and (3) any of the severe primary anemias.

Caution. Pentothal sodium given by rectum usually acts within from five to fifteen minutes, and the authors do not advise its administration until the surgeon is preparing for operation. Because of the relaxation of the jaw and tongue, the patient requires observation after the drug is given to avoid asphyxia. It is good practice to have an airway handy in the event asphyxia should occur. When possible, the presence of the anesthetist is advisable during the induction of the drug.

SPINAL ANESTHESIA WITH RECTAL PENTOTHAL SODIUM BASAL NARCOSIS

The authors are convinced, after a fairly wide experience, that pentothal sodium basal narcosis is synergistic to the drugs commonly used in producing spinal anesthesia. The advantages afforded by this combination may be stated briefly as follows: less depression of the blood pressure, less frequent occurrence of shock and unfavorable side effects, and a prolonged period of anesthesia and analgesia.

COMPARISON OF CASES GIVEN SPINAL ANESTHESIA WITH RECTAL PENTOTHAL BASAL NARCOSIS AND CASES GIVEN OTHER PREMEDICATION

The authors present for comparison a complete report of 129 cases of spinal anesthesia with rectal pentothal basal narcosis, and of 119 cases of spinal anesthesia with morphine sulfate (gr. 1/6), nembutal (gr. 3), or sodium luminal (gr. 2), for premedication (113 cases, 3 cases, and 3 cases, respectively). Each group contained comparable numbers of exploratory laparotomies, herniotomies, appendectomies, and pelvic and orthopedic operations. However, the pentothal-sodium series included 16 cholecystectomies not found in the other groups; and the "other premedication" series included 2 stomach operations not found in the pentothal-sodium series.

A study of the blood-pressure recordings in these 248 cases of spinal anesthesia revealed that the blood pressure did not change appreciably in 36 per cent of the total pentothal-sodium cases, as compared with 23 per cent of the "other premedication" group. The systolic pressure rose to some degree after spinal injection and stimulant dosage in 26 per cent of the pentothal-sodium series and in only 9 per cent of the "other premedication" series. Finally there was a drop in blood pressure in 38 per cent of the pentothal-sodium cases as compared with 68 per cent of the other group. The drop in blood pressure was not as marked in the pentothal-sodium group as is usual after administration of spinal anesthetics following other premedication.

In the 129 cases of spinal anesthesia with pentothal-sodium basal narcosis only 8 (or 6 per cent) of the patients did any retching or vomiting, and these to no great extent. In the series of 119 cases with other premedication, however, a total of 30 (or 25 per cent) reacted in this manner to some degree.

Relaxation from spinal anesthesia is of longer duration in patients to whom pentothal sodium has been administered rectally as a preliminary basal anesthetic. Of the 129 cases here reported in which rectal pentothal-sodium basal narcosis was used in combination with spinal anesthesia, 26 were laparotomies which lasted two hours or longer and these received a light gas anesthetic (nitrous oxide-oxygen, or cyclopropane-oxygen) the last hour or longer. However, all 26 patients were well relaxed for closure of the abdomen and none required deep general anesthesia. This group included 14 major cases in which the operation lasted one and one-half hours and 2 cases in which it lasted two hours and required no supplemental anesthesia. As a rule, however, these patients required supplemental gas anesthesia after an average of one hour's sleep under pentothal sodium. Frequently relaxation persists longer.

DETERMINATION OF DOSAGE OF PENTOTHAL SODIUM

The dosage of pentothal sodium is determined chiefly on the basis of weight and metabolism of the patient. One gram for each 50 lb. of body weight is the general rule. This quantity is increased somewhat if the patient has hyperthyroidism, is very worried over the impending surgery, or has recently been receiving barbiturate medication. On the other hand, the dosage may be a little less than 1 gm. per 50 pounds of weight if the patient is extremely obese, in poor physical condition, or of the phlegmatic type.

The dose decided upon is weighed out and dissolved in 1 oz. of distilled water, and is given per rectum through a small catheter. This is administered in the patient's room about twenty minutes before the scheduled time of operation. (As pentothal sodium solutions are relatively unstable, the distilled water is not added to the weighed powder until shortly before administration.) Preceding the instillation of the pentothal sodium, atropine sulfate (gr. 1/150) is given by hypodermic injection. Also, preferably the patient has been given a cleansing enema of normal saline solution the preceding evening or at least several hours before operation, but this is not absolutely necessary since the volume of fluid for instilling pentothal sodium rectally is so small.

Within from five to fifteen minutes after the injection of the pentothal sodium solution, the patient becomes drowsy and quietly goes to sleep. In the event too small a dose was decided upon and the patient does not go to sleep, a second and smaller dose is given rectally, or a very small amount of pentothal sodium in a 2.5 per cent solution is given intravenously. (In giving pentothal sodium intravenously after rectal administration, great care must be exercised to give the solution slowly and to watch the patient closely, as a surprisingly small quantity, often as little as from 0.2 to 0.3 gm., is sufficient to produce deep anesthesia.) At least twenty minutes should elapse after instillation of the pentothal sodium rectally before supplemental doses of pentothal sodium are administered as the action of the former may be somewhat delayed. Supplemental doses of the pentothal sodium usually are given in the operating room. Although the patient may not be sound asleep from the initial dose of pentothal sodium, he is practically always drowsy or euphoric and no longer sees his predicament as a serious matter, and although seemingly awake, as a rule, he will have no recollection of the trip to the operating room.

In all 248 cases here reported neosynephrin (¼ to ½ cc.) or ephedrine sulfate (gr. ⅜ to ¾) was given by hypodermic injection prior to the injection of the

spinal anesthetic. Neosynephrin (¼ to ½ cc.) was given in the majority of cases because of the tendency of ephedrine to cause cerebral stimulation and to awaken the patient, particularly in cases having received pentothal sodium. The patient is then placed on his side and the spinal anesthetic is given in the usual manner. The operation proceeds without delay, and in the majority of cases the patient remains asleep or very drowsy for about one hour. If during the course of the operation a second dose of stimulant is needed and the pulse is below 70 ephedrine (gr. ⅜) should be given; or if the pulse is over 70, a second dose of neosynephrin (¼ cc.) is given. In the event the patient begins to rouse, he usually is co-operative and calm, a sense of well-being seeming to remain with him. Some patients become restless, and in these cases a light gas anesthetic or a small intravenous dose of pentothal sodium may be given. Here again little anesthesia is required to produce sleep.

ERNEST E. ARNHEIM, M.D.

Hammes, E. M.: Neurological Complications Associated with Spinal Anesthesia. *Minnesota M.*, 1943, 26: 339.

Since Corning's first report on spinal anesthesia in 1885, when he injected cocaine hydrochlorate into the spinal cord, experimental studies, clinical observations, and refinement in technique and anesthetic agents have combined to make spinal anesthesia a method of choice for many surgeons.

A review of the literature shows many authors at variance in their opinions about the effect of the anesthetic agents on the spinal cord. Such authors as Vehrs, Foss and Shwalm, Lundy, and Koster and Kasman, believe that none of the complications encountered following spinal anesthesia is due to the agent or the method, but is either inherent to the disease or to the technique. On the other hand, Davis and his coworkers, Haven and Spielmeyer, believe that the various spinal anesthetics are both hemolytic and myelitic and cause varying degrees of inflammatory reaction in the leptomeninges and in the cord itself. Hayman and Wood suggest that abducens paralysis following spinal anesthesia is not due to the toxic effect of the drug but probably due to a disturbance in dynamics of the spinal fluid.

A wide variety of neurological complications, either immediate or remote, may follow spinal anesthesia. In a thorough review of the literature, comprising over 60,000 cases of spinal anesthesia, Light and his coworkers listed as sequelae: (1) headaches; (2) sensory disturbances; (3) cranial nerve involvement, especially of the sixth nerve; and (4) impaired bladder and rectal function. They also noted other more serious spinal-root and cord disturbances. Preexisting disease of the central nervous system is considered a definite contraindication to spinal anesthesia.

The author reports 8 cases of neurological complications associated with spinal anesthesia, 6 of which are described in detail. Five patients had organic neurological disorders previous to the spinal anesthetic.

This very comprehensive digest demonstrates the extreme importance of thorough preoperative neurological examinations and brings out the fact that the chemotoxicity of various spinal anesthetics aggravates pre-existing neurological diseases. However, serious complications in individuals neurologically normal are relatively infrequent, and in properly selected cases spinal anesthesia holds an important place in the surgeon's armamentarium.

MARY KARP, M.D.

Bakst, H. J., and McCormick, G. W.: The Use of Local Anesthesia in the Treatment of Contusions and Sprains. *U. S. Nav. M. Bull.*, 1943, 41: 107.

Local anesthesia has many advantages when used in the treatment of chest injuries, ankle sprains, and back injuries. To enumerate, pain is immediately and completely relieved so that an immediate full duty status often is possible. This is important during war in which the replacement of personnel is not always feasible, especially in outlying bases. Sedatives and narcotics can be cut down or may be unnecessary. The patient can usually be followed up as an out-patient. Excessive coughing is reduced in chest injuries. The procedure, being a minor one, can be carried out with a minimum of preparation and loss of time, but one definite disadvantage of this method is that it is not adaptable to open, dirty wounds.

The technique described follows that of Leriche and Arnulf. A 2 per cent solution of procaine hydrochloride has been found entirely satisfactory. From 10 to 20 cc. of procaine are adequate. In all instances, complete relief of pain follows immediately. After one-half hour to two hours, there may be some return of pain, but this usually abates in the course of the next few hours. The lumbosacral and sacroiliac strains are treated according to the method of Soto-Hall. A needle is inserted over the sacrum midway between the two posterior superior spines of the ilia. Fanlike infiltration along the posterior aspect of the sacroiliac joint is accomplished.

The report covers 30 cases: 6 contusions of the chest wall, 19 ankle sprains, 2 sacroiliac injuries, and 3 lumbosacral injuries. The reduction of the number of sick days and the relative simple means by which it may be accomplished, makes the use of local anesthesia a desirable and valuable method of treatment.

MARY KARP, M.D.

Dealy, F. N.: Anesthetic Deaths. A Five-Year Report. *Am. J. Surg.*, 1943, 60: 63.

An investigation of the occurrence of accidental deaths in the operating room, or of deaths occurring immediately after operation, was made by a committee appointed by the Medical Board of Queens General Hospital, Jamaica, New York. The report covers a period of five years, from January 1, 1936, to January 1, 1941; it is limited to operating room

fatalities and does not include all possible late anesthetic deaths. Nineteen thousand, five hundred and twenty-nine anesthetics were administered during this period of time.

Twenty-nine deaths in the operating room or within a short time after completion of the operation were investigated. Eleven cases were eliminated from further investigation because of the fact that the fatal outcome could not be attributed to the anesthetic. None of the patients who had received a spinal anesthetic, however, was rejected, as it was believed that each of these, regardless of circumstances, should be exposed to a full and searching examination. Seven deaths occurred during inhalational anesthesia, 7 during spinal anesthesia, and 4 during rectal anesthesia. A detailed account of each of the 18 deaths is given.

Usually, the great interest in the whole question of anesthetic deaths seems to center upon those which occur under spinal anesthesia. In all of the deaths cited, there was less reason to attribute the cause of death to spinal anesthesia, since 4 of the operations were emergencies, practically all the cases were desperate, and the pathological condition in all of the patients was adverse and sufficient in itself to result in fatality. As to the deaths which occurred under inhalation anesthesia, it appears that only 1 case was an emergency, and that the pathological status in the majority of the patients was comparatively uncomplicated. Nevertheless, despite this evidence, it was the deaths under spinal anesthesia that prompted the investigation.

In 6 of the 7 deaths under spinal anesthesia, pantocain was the drug employed. The study, however, brought out the fact that administration of the drug in these cases was considered faulty for the reason that it was given without the admixture of glucose; it was used in unnecessarily large doses; and proper attention was not paid to the position of the patient on the table, either at the time of the spinal injection or during the subsequent operative procedure.

By the restricted use of isobaric solutions, and the selection of hyperbaric or hypobaric solutions in accordance with the requirements of the case, with meticulous attention to the appropriate position of the patient on the table, as well as to other necessary technical points, it is believed that the dangers from spinal anesthesia can be minimized.

The following recommendations were made:

The anesthetic services should be improved and be under the direction of medically trained, skilled anesthetists. Records should be more accurately kept. Medical consultations, to evaluate the patient anesthetically, should be more frequently requested. Better facilities for intratracheal anesthesia should be available.

More careful discrimination in the selection of the form of anesthesia and anesthetic agent should be employed.

A wider knowledge of use, action, effects, dangers, and technique of administration of the various drugs employed for spinal anesthesia should be had. More careful attention should be paid to the administration of spinal anesthetics. MARY KARP, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Stewart, H. J., Carty, J. R., and Seal, J. R.: Contributions of Roentgenology to the Diagnosis of Chronic Constrictive Pericarditis. *Am. J. Roentg.*, 1943, 49: 349.

Chronic constrictive pericarditis was first described in 1669. Pick described the clinical features of this disease in 1896 and since that time it has frequently been known as "Pick's disease." In 1913 the first pericardiectomy was done. Pertinent roentgen findings in 15 cases were described by White in 1935.

The authors report 16 cases, in 14 of which pericardiectomy was done. The ages of the patients varied from seven to fifty-eight years, the majority being in the third decade. There were 12 males and 4 females. The duration of symptoms as given in the history varied from two and one-half months to fifteen years. In 1 case there was a history of tuberculosis, in 2 a history of rheumatic fever, and in 7 a history of nonspecific pulmonary infection. Pericardial effusion was present in 2 cases.

Dyspnea was present in 13 cases, involvement of the abdomen in 10 cases, and edema of the lower extremities in 9. Paradoxical pulse, distention of the cervical veins, and increased venous pressure were the pertinent physical findings. The electrocardiogram revealed slight axis deviation in 7 cases and low amplitude of the QRS complexes; and the T wave was either diphasic or negative and often cove-shaped in Leads II and III.

The roentgenoscopy in most cases was of considerable diagnostic importance. Posteroanterior and lateral chest films were taken, the latter frequently overexposed. In addition, fluoroscopy and kymograph studies were made. In most cases the chest cage was square-shaped with widening of the lower diameters. This was presumably due to longstanding ascites with outward pressure of the costal margins. In 6 cases the lateral cardiac shift with change in position and downward descent with inspiration was limited. There was diminished cardiac pulsation in all of the cases. This was confirmed by kymograph studies. The cardiac silhouette was slightly enlarged in 4 cases, moderately enlarged in 7, markedly enlarged in 2, and smaller in 3. There was calcification of the pericardium in 4 cases. The superior mediastinum was normal in 7 cases, slightly wider in 5, and moderately wider in 2. The aortic knob was not visualized in 5 cases; in 9 it was small and flattened; in 1 it was normal; and in 1 it was slightly enlarged. (In the last case there was hypertension in a man fifty-eight years of age.) Although some cases revealed an increase in the bronchovascular markings, there was no direct relationship between the increased markings and dyspnea. Pleural effusion was present in 11 cases.

The authors conclude by stressing the diagnostic features of chronic constrictive pericarditis as follows: (1) venous engorgement, serous effusion, and hepatomegaly indicate obstruction to the flow of blood through the heart; (2) the heart may be small or slightly enlarged by abnormal configuration; often there is a rim of calcium around the periphery; (3) the aortic knob is absent, small, or flattened; (4) the cardiac pulsation as seen in fluoroscopy and kymogram studies is diminished; (5) the cardiac shift is absent when the patient is tilted from side to side and cardiac elongation is limited with descent of the diaphragm; and (6) pulmonary congestion, pleural thickening, or effusion may be present.

MAURICE D. SACHS, M.D.

Cullen, C. H., and Chance, G. Q.: Air Arthrography in Lesions of the Semilunar Cartilages. *Brit. J. Surg.*, 1943, 30: 241.

After briefly reviewing the literature relative to the use of contrast materials in the diagnosis of joint lesions, the authors present their experience with injecting air in a series of patients with a preliminary diagnosis of internal derangement of the knee joint. They undertook the investigation in an attempt to correlate the roentgenological with the clinical and operative findings.

They describe the details of the technique used, stressing positioning of the part in such a manner during roentgenography so that the central beam passes through the portion of the cartilage to be examined and through as little else as possible. The tangential nature of these views is of the utmost importance and makes the films more interpretable by elimination of confusion caused by the superimposition of shadows. The films were interpreted without any clinical knowledge of the cases and the opinion was checked, in nearly all cases, by the findings at operation. Roentgenograms of normal and pathological knees are included.

The authors have recognized five types of findings:

1. Separation of cartilage from the lateral ligament.
2. Separation of cartilage from the tibia.
3. Fracture of cartilage.
4. Fracture of cartilage with displacement of the fragment.
5. Fragmentation, reaching almost complete disappearance in some cases.

Thirty-two cases are reviewed. Twelve of these presented definite clinical signs of cartilage lesions, 10 were doubtful (with 5 each probably positive and negative), and 10 had no clinical evidence of cartilage lesions. Twenty-two of these cases came to operation. The pathology found at operation and the findings of the air arthrograms in them are tabulated. Air arthrograms showed definite lesions in 18 of the 22 patients whose knee joints were

explored. Seventeen of them would have had operation on clinical grounds; the remaining 5, in all of which definite lesions were found at operation, would probably have been rejected on these standards. The arthrographic findings in the nonoperative cases are also mentioned. The subsequent course of these cases made it likely that the diagnosis was correct.

The authors drew the following conclusions:

Air arthrography is a simple painless method of examination. By its aid the semilunar cartilages in the knee can be visualized, and definite help given to the clinician in the diagnosis of difficult cases. There is a high percentage correlation between the clinical and roentgenological diagnosis. The method is worthy of extended trial, and roentgenographs taken in conjunction with the clinical picture can increase the percentage of positive cases coming to operation. A. HARTUNG, M.D.

Cade, S., McWhirter, R., Richmond, J. J., and Keynes, G.: Discussion on the Value of Irradiation in Association with Surgery in the Treatment of Carcinoma of the Breast. *Proc. R. Soc. M.*, Lond., 1943, 36: 237.

CADE briefly reviews various factors which have prognostic significance and must be given consideration in evaluating the results obtained by surgery or irradiation separately or in combination in the treatment of carcinoma of the breast. He presents several statistical tables from various sources showing survival rates obtained by different methods of treatment in various stages of the disease. His own findings in a series of 213 cases treated by radium and surgery combined or by radium alone are also included. Analysis of results indicates that radiation materially improves the survival rate. He concludes that combined surgical and radiological treatment is the treatment of choice. Skilled radiotherapy is no longer an auxiliary method but of equal and, in some cases, of greater importance than surgery.

MCWHIRTER favors combined irradiation and surgical treatment for breast cancer because he believes that operative procedures alone frequently fail to remove all malignant cells in the operation area and that such residual cells can often be destroyed by adequate postoperative therapy. He bases this opinion on an investigation made upon two similar series of cases, one of which was treated by radical operation but not receiving any postoperative radiotherapy as part of the originally planned treatment, and the other by operation and by complete postoperative irradiation. He stresses adequate radiation and describes what he considers minimal doses. One of the objects of the investigation was to determine the frequency of recurrences at a later date.

The findings of the investigation which are tabulated revealed that the symptom-free rate for three years closely approximated that of the five-year survival rate. It was evident that effective postoperative radiotherapy reduced the local recurrence rate and many potential failures were converted into successes and the three-year symptom-free rate was materially raised.

RICHMOND gave special consideration to combined preoperative and postoperative irradiation and cited some results from the literature relating to that procedure. The key to the position probably lies in a study of the pathological grading or degree of malignancy of the tumors comprising each operable group. The results in Stage I cases, commonly revealing a high percentage of five-year survivals after radical mastectomy, can be improved by postoperative irradiation except in the relatively small number of histologically Grade 1 cases which can be safely treated by surgery alone. In Stage II a high proportion of the cases fall into the more malignant Grades 3 and 4. Consequently a course of preoperative therapy should be administered for two weeks and then radical mastectomy should be performed. This should be followed in three weeks with a course of postoperative irradiation. It is in the undifferentiated tumors of Stage II that the combination of preoperative and postoperative irradiation has improved the survival rate considerably.

On the other hand, it is unwise to perform radical mastectomy in cases which originally definitely fell into the inoperable Stage III class, but apparently became operable subsequent to a course of irradiation. This does not apply to cases which were initially on the borderline of operability. The irradiation may have caused quite dramatic regression of the tumor, but it cannot be assumed that it has changed the original pathological grouping of the case. Unquestionably, radiotherapy is the treatment of choice for these patients.

KEYNES was in agreement with Cade's opinion.

A. HARTUNG, M.D.

Hinkel, C. L.: The Effect of Roentgen Rays upon the Growing Long Bones of Albino Rats. Histopathological Changes Involving Endochondral Growth Centers. *Am. J. Roentg.*, 1943, 49: 321.

The experimental work of other observers is briefly reviewed. It is known that sufficiently large amounts of roentgen and gamma rays produce recognizable changes in all living cells. Although fibrocartilage and hyaline cartilage are resistant to large amounts of radiation, the cartilage columns in the ends of growing bones can be modified by quantities of roentgen rays which produce no grossly perceptible changes in the skin through which they pass.

Sherman-strain albino rats of various ages were irradiated under anesthesia by a single dose of 200 kv., copper-filtered roentgen rays. The irradiated field was 5 mm. in diameter and included the right distal femoral growth center. The left femur of each animal served as the unirradiated control.

The microscopic abnormalities become evident before there is appreciable interference with growth. Stunting, when it occurs, is apparently the result of temporary retardation or cessation of cartilage growth in a distal direction, due to a direct effect

upon the dividing cells. Other more lasting secondary effects are explained on the basis of injury to the vessels, osteoblasts, and marrow cells. Particularly in young animals, histopathological changes appear promptly after relatively low doses, and are followed by complete return to normal. In the older age groups, larger quantities of roentgen rays are required to produce abnormalities, which appear later and last longer.

Under these circumstances, the quantities of roentgen rays required to inhibit growth also produce such marked changes in supporting tissues, bone marrow, and blood vessels, that if cartilage regeneration occurs it is incomplete and growth remains subnormal. HAROLD C. OCHSNER, M.D.

RADIUM

Ledermann, M., and Mill, W. A.: The Teleradium Treatment of Intrinsic Cancer of the Larynx. *J. Lar. Otol.*, Lond., 1942, 57: 471.

From 1929 to 1941, 39 cases of intrinsic laryngeal carcinoma were treated at the Royal Cancer Hospital, London. Of these, 9 were recurrences. In the majority of cases the condition had reached an advanced stage. Four patients were treated by radium insertion followed by external irradiation; 35 patients received teleradium therapy which, in 16, was given by means of a 1 gm. radium unit, and in 19 was given by means of a 5 gm. radium unit.

The average age of the patients was fifty-seven and one-half years, the oldest patient being seventy-nine years and the youngest twenty-five years. All but 1 were males.

Most of the lesions were intrinsic; that is, the lesion involved the true cord, the false cord, and the ventricle, or subglottic region. In all but 3 cases there was involvement of the true cord; the false cord or ventricle was involved in 2 cases and the postcommissure in 1 case. A positive biopsy was obtained in 21 of 26 previously untreated cases.

In early lesions, a laryngofissure was the treatment of choice, and the results were good. Four patients were operated upon by this method. In moderately advanced cases, laryngectomy was the method of choice, and the results were fair. Of 22 cases, 10 were suitable for laryngectomy. Although 9 cases were considered operable, the authors decided not to operate because of the presence of some concomitant disease. Three cases were too far advanced for surgery.

In advanced cases, irradiation therapy was palliative. Two 3.5 cm. or 5 cm. lateral fields were centered over the thyroid. Sometimes a third field, centered over the Adam's apple, was used. Additional fields were used in cases in which the regional lymph nodes were involved. A tumor dose of from 6,000 to 7,000 roentgens was given in a four to six-week period by treating two fields per day, each field receiving between 300 and 350 roentgens per treatment.

Tracheotomy should be avoided because of the risk of bronchopneumonia. Cases requiring tracheotomy are generally far advanced.

Dysphagia, cough, and respiratory distress are relieved by aspirin, or by a percaine (1 to 1,000 solution) gargle. Reaction of the skin to irradiation is best treated by keeping the skin dry, and by avoiding friction. In a moist desquamation of the skin, the authors use a triple-dye spray containing crystal violet, brilliant green, and proflavine in a glycerogelatin base. The use of an oily dressing is avoided because healing is slower, drainage is obstructed, and there is a tendency toward secondary infection.

No cases of postirradiation laryngeal stenosis were seen. The usual skin changes were observed; however, the cosmetic results were excellent. Return to normal vocalization was slow.

Postsurgical recurrences were best treated by irradiation. If the physical condition of the patients permitted, those with postirradiation recurrences were best treated by surgery. Cervical lymph-node metastasis, provided no previous irradiation had been given, was best treated by radiation therapy. If roentgen therapy had been used, then surgery was attempted, if it was possible; if not, the next course of roentgen therapy was merely palliative.

In the opinion of the authors, surgical technique in laryngeal carcinoma has reached its peak, but irradiation technique is still relatively undeveloped and should be given every opportunity for development to its fullest extent. In order to obtain the best results, a sense of balance should be maintained between the work of the conservative surgeon and that of the enthusiastic radiation therapist.

MAURICE D. SACHS, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Luchsinger, R.: Voice and Speech of Cretins (Ueber die Stimme und Sprache der Kretinen). *Schweiz. med. Wschr.*, 1942, 72: 811.

The author studied the speech and voice of 17 cretins and made otolaryngological studies. In addition to the atrophy of the thyroid gland and the usually present hypogenitalism, total or half-cretins usually show a marked retardation of growth of the larynx, with various degrees of dysfunction.

The nearly always present endemic impairment of hearing, caused by a process in the internal ear, is responsible for a speech which is characteristic for people hard of hearing or with a low mentality; in addition to it, an organic-dysarthric component is a factor responsible for the peculiar speech of cretins.

The author's observations on living cretins were supplemented by pathologicoanatomic studies of the larynx and the thyroid gland of 2 cretins. In 8 cretins the range of the voice was very narrow, extending from few tones up to one octave. In 11 cases there was a palpable hypoplasia of the larynx, similar to that found in 2 pathological specimens. Only in 4 cases did the speech reach the lower limit of voice in normal individuals. In these 4 cases signs of a grave insufficiency of the thyroid gland were absent and the endemic debility and impairment of hearing were not very pronounced.

Contrary to eunuchoidism, the growth of the larynx in hypogenitalism is retarded so much that the development of the sonorous voice of castrated individuals cannot be expected. Cretins with hypogenitalism showed signs of a hypoplasia of the larynx and an infantile timber of the speech but no sonorous voice was present. A cretin's voice resembles the voice of an old man; it is caused by a dysfunction of his endocrine system. It is difficult to determine whether the muscular weakness of cretins plays any role in the type of the voice.

In 12 cases a pronounced stuttering was present. Frequently a nasal speech was observed; it probably served as an expression of weakness of innervation. The voice defects cannot be considered a result of mental deficiency but are the sequels of inhibition of the development of speech, due to disturbances in the motor sphere. The speech of cretins is usually monotonous, not only the musical but also the dynamic accent suffers. Cretins with impairment of hearing frequently speak in a low voice and very slowly. Either stuttering or, more frequently, stammering is observed. Stuttering has no causative relations to the endemic goiter. The fact that stuttering is frequently inherited speaks against such assumption. The author rejects also the thought that the thyroid dysfunction is a causative factor in the development of stuttering.

In 11 cases an endemic impairment of hearing was caused by dysfunction of the internal ear with participation of the middle ear. The author calls attention also to exceptionally wide nasal cavities with a resulting dryness of the mucous membrane. However, ozena was not present.

JOSEPH K. NARAT, M.D.

Howes, W. E., and Birnkrant, M.: Melanoma. A Review of 32 Cases Admitted to the Brooklyn Cancer Institute during a Five-Year Period. *Am. J. Surg.*, 1943, 60: 182.

Melanoma can be defined as a malignant tumor derived from pigment-producing cells. Nevosarcoma, melanosarcoma, malignant nevus, and nevocarcinoma are other terms used to describe this lesion. Nevus or mole, on the other hand, represents a benign process; it is congenital and is closely associated with the melanoma both in its gross and microscopic appearance. The term nevus is used interchangeably and may be used to designate a pigmented mole, a hemangioma (a vascular lesion) or a lymphangioma (a lymphoblastic tumor).

Fifty-four per cent of the skin melanomas reviewed gave a history of having had a pigmented mole at the site of the lesion "all of my life."

Some investigators consider the common mole a precancerous lesion which may be activated by injury, irritation, inflammation, or endocrine stimulation, whereas others subscribe to a modified Connheim theory, believing that a melanoma starts as a "quiescent" new growth which consists of congenitally misplaced and potentially malignant cells. These cells may suddenly become activated and develop all the characteristics of a malignant growth because of some unknown factor, intrinsic or extrinsic. When a pigmented lesion increases in size, changes color, ulcerates, crusts, oozes, bleeds, becomes elevated, itches, pains, or exhibits any detectable variation from its usual appearance, malignant activation is to be suspected.

Thirty-two cases of melanoma entered at the Brooklyn Cancer Institute in the five-year period between 1936 and 1942 are reviewed and results are summarized. From these records it appears that this tumor most frequently metastasizes first to the regional lymph nodes. This spread may occur after an interval of from three months to six years. The most frequent site of distant metastasis was found to be the lung, liver, and bone. The latent period before the development of distant metastases was two years and eight months.

The review rather dramatically demonstrates the inadequacy of dealing with a melanoma by single or multiple local excisions. There was not a single survival in this group, while with more radical excision 7 of 10 have survived, averaging over five years. It is appreciated that many successful local removals

may be performed and that unless there is recurrence the case may never be referred to a Cancer Hospital.

The best results were obtained in this series by radical local removal. The authors, however, agree that this should be followed, whenever possible, by regional lymph-node dissection from a week to two weeks after radical excision of the primary growth. Radiation therapy is discouraged except for treatment from a palliative angle.

JOSEPH K. NARAT, M.D.

Stocks, P.: Mortality of Men between the Ages of Fifty and Sixty-Five Years. *Lancet*, Lond., 1943, 244: 543.

Recently a paper by Korenchevsky pointed out that, since the professional man does not in most instances reach a position of high responsibility or one in which his abilities are given full scope before the age of 50, the physiology and pathology of aging in mid life may be an important factor in total war. This conclusion finds support from a study of the death rates of men between the ages of fifty and sixty-five, which have presented some unsatisfactory features in recent years.

The author calls attention to the danger of forgetting that considerable burdens are being carried by men over fifty and that the maintenance of their health is a vital factor in winning the war and the peace to follow it. The accumulated experience of a professional man is a national asset which cannot be replaced quickly, and at present men between fifty and sixty-five form a substantial proportion of the workers in many essential industries.

A statistical review made in England in 1937 pointed out that the improvement in death rates of men over forty-five was not keeping pace with that of women of the same ages. The rates in the review for 1939 again showed that at the age group between 55 and 65 among men little or no progress was made.

A survey of painstaking tabulations of records going back to 1891 brings out the following facts. During the twenty years before 1911 the expectation at twenty-five of dying before fifty was falling for men at the rate of about 10 per cent every five years, and the expectation at fifty of dying before sixty-five was falling at the rate of about 5 per cent every five years. During the next two decades the rate of fall in the mortality expectation at 25 was reduced to 7 per cent every five years, but during the period before World War I (from 1914 to 1918) it increased again to 10 per cent every five years. In contrast with this, the expectation at fifty of dying before sixty-five, for men, fell more slowly after 1922 and did not change at all in the period from 1930–32 to 1937–39, being slightly over 1 in 4 at both dates. For women attaining fifty the expectation of dying before sixty-five fell at the rate of about 7 per cent every five years during the period before 1922, and was still falling by 6 per cent per five years between 1930–32 and 1937–39.

The question arises, What were the causes of death responsible for the failure of the male death rates to improve between 1931 and 1941 in conformity with those of females at the same ages and both sexes at younger ages? The author endeavors to answer this question by a careful study of the cause of death in the different age groups. Reviewing carefully the rates for tuberculosis, syphilis, nephritis, cancer, respiratory diseases and influenza, cerebral hemorrhage and arteriosclerosis, digestive diseases, and heart diseases, the author concludes that heart diseases are far in the lead as a cause of death. For heart diseases the total death rate showed a steady increase from 1921 to 1940 in each age group, followed by recovery almost to 1938 levels in 1941. The increase has been confined to coronary disease, angina pectoris, and diseases of the myocardium. The combined rate for these rose among men between fifty and sixty-five by about 70 per cent from 1930–32 to 1939. Among women of the same ages the corresponding increase in this period was 30 per cent. The problem assumes gigantic proportions and is similar to the problems presented by diphtheria, tuberculosis, prematurity, and road accidents which are receiving special attention at the present time.

The Registrar-General's Occupational Mortality Report for the period from 1930 to 1932 showed that coronary disease and angina pectoris were much more frequently certified as causes of death among men in professional and sedentary occupations, and myocardial disease more often among men in manual occupations. MATHIAS J. SEIFERT, M.D.

GENERAL BACTERIAL, PROTOZOAN, AND PARASITIC INFECTIONS

Cooke, J. V., and Jones, F. G.: The Duration of Passive Tetanus Immunity and Its Effect on Active Immunization with Tetanus Toxoid. *J. Am. M. Ass.*, 1943, 121: 1201.

Because of the thousands of military and industrial workers who are in need of tetanus immunization, this article is most opportune. A prevailing opinion, that active and passive tetanus immunity can be produced at the same time, is herein shown to be false. The "simultaneous serovaccination" of antitoxin and a series of three toxoid injections beginning at the same time do not sensitize the body so that a later stimulating dose of toxoid is of any value, because the presence of the antitoxin appears to counteract the sensitizing property of the toxoid shots so that there is no primary response of the body cells. Therefore, the authors recommend that active immunization with three doses of toxoid be delayed until from two to four weeks after the antitoxin has been used. This method produces suitable sensitization so that a later dose of stimulating toxoid will raise the blood tetanus antitoxin titer to an effective level. After antitoxin is given, spaced injections of alum toxoid (which are slowly dissolved and absorbed), may be begun at the approximate time of low passive immunity so that antigen will become available for the stimulation of an active immunity as soon as the inhibition by anti-

toxin disappears. Because of its prolonged absorption, the alum toxoid may be of more value than the quickly absorbed plain toxoid when efforts are being made to keep an immunity at a high titer. Thus, the passive immunity is converted into an active immunity without the patient's blood even reaching a low antitoxin titer.

Passive antitoxin immunity has been judged previously to be effective for about three weeks, but with larger doses of antitoxin (although early high titers fall rapidly) a low titer persists in the blood for a longer time. The author's observations would extend this time to about eight weeks after larger doses of tetanus antitoxin.

An attack of tetanus itself does not produce an immunity, nor does it produce any primary stimulus which sensitizes a patient to tetanus immunization. Nor will subcutaneous or intracutaneous injections of tetanus toxoid stimulate a more rapid development of antitoxin; however, such injections are of value if there have been one or more sensitizing toxoid inoculations.

The antitoxin titer of the spinal fluid was found to be only 0.2 unit, while that of the blood was from 30 to 50 units in 1 case; in another case the titer was from 0.03 to 0.1 unit per cc. when that of the blood was from 50 to 100 units.

This article suggests and clarifies a procedure which has heretofore been indefinite and questionable, and, is therefore, a welcome addition to every clinician's "repertoire." ADRIEN VERBRUGGHEN, M.D.

DUCTLESS GLANDS

Astwood, E. B.: The Treatment of Hyperthyroidism with Thiourea and Thiouracil. *J. Am. M. Ass.*, 1943, 122: 78.

Two series of chemical compounds have been found to possess the unique property of inhibiting the endocrine function of the thyroid gland. The administration of these agents to experimental animals is followed, after a short latent period, by a lowering of the basal oxygen consumption. A decrease in the rate of growth and development and a diminished food intake—changes which are consistent with a state of hypothyroidism in certain animal species—these changes are accompanied by a hyperplasia of the thyroid gland which is apparently compensatory in nature and mediated by the anterior lobe of the pituitary gland.

More than a hundred compounds have been tested in order to select highly active substances of low-toxicity for clinical use. Most of the derivatives of thiourea exhibited some activity but varied widely in toxicity, thiourea itself being the least toxic of all. Second, thiouracil was the most highly active compound tested and the minimum lethal dose of this substance in rats was more than 100 times the dose necessary to produce a detectable thyroid effect.

A second series of active compounds includes a number of aniline derivatives such as p-aminobenzoic acid, p-aminophenylacetic acid and related compounds, and all of the commonly used sulfonamides. This class of substances, with the exception of the highly active sulfadiazine, was considerably less active than the thioureas.

From a clinical point of view thiourea and thiouracil appeared to be the most promising and were therefore used in studies on normal persons and on patients with hyperthyroidism. Three cases were studied sufficiently long to be reported.

The daily administration of from 1 to 2 gm. of thiourea or from 0.2 to 1 gm. of thiouracil to hyperthyroid persons resulted in the relief of symptoms and the return to normal of the serum cholesterol and the basal metabolic rate, signs of early myxedema occurring in 1 patient. There were observed a latent period of one or two weeks before these effects occurred, a sustained remission during treatment, and a return of hyperthyroidism when therapy was discontinued. EARL O. LATIMER, M.D.

Wilensky, A. O.: The Relationship of Thyrotoxicosis to the Present War Effort; Its Modern Treatment. *Am. J. Surg.*, 1943, 60: 221.

During World War I the incidence of exophthalmic goiter was 2.78 per 1,000 and the incidence of simple goiter was approximately one-sixth of that of exophthalmic goiter. It is reasonable to expect a similar incidence among inductees in the present conflict.

For clinical purposes the author divides the cases of thyrotoxicosis into four groups:

1. Exophthalmic goiter with exophthalmos. This group is frequently difficult to prepare for surgery and operation carries with it a considerable risk. Recurrences are very apt to follow surgery.

2. Thyrotoxicosis without exophthalmos. Preparation of these patients for surgery is not difficult. Operation is not attended with any excessive degree of danger and postsurgical recovery is usually permanent.

3. Thyrotoxicity as mentioned with the superimposition of psychotic symptoms. Residual symptoms of this group always include those related to the mental state.

4. Localized adenomas of the thyroid with symptoms of mild hyperthyroidism. There is a minimum of risk attendant upon operation and recurrence of symptoms is contingent only upon the development of new adenomas.

Preparation of the patients for surgery does not differ from that of civilians having the same disease. Because of the intolerance of thyrotoxic patients to heat the author suggests that the Government move such patients to the cooler areas in the summer time to prepare them for surgery. He makes another pertinent suggestion that they be placed in private rooms to remove external stimuli rather than leave them in a ward for preoperative preparation.

The following regime is used by the author.

1. Rest in bed under hospital conditions.

2. A high caloric diet of not less than 3,500 calories per day.

3. Plenty of sedation, medication consisting chiefly of phenobarbitol, and physical treatment—hydrotherapy in the form of the Priesnitz pack (wrapping the patient in sheets wrung out of water at a temperature of 60°F). Some patients, however, are refractory to this form of hydrotherapy, and it should be omitted in such cases.

4. Weekly determination of the basal metabolic rate as an index of the improvement of the patient.

5. Withholding iodides until the effect of preliminary treatment has become effective. The dosage of Lugol's solution should be not less than 10 minims administered three times a day—sometimes more is required. If iodine therapy does not produce further improvement of the symptoms within from twelve to fourteen days the chances are that it will have no effect.

6. One-stage operation, the operation to be withheld until the patient is in the best possible condition, neither the patient nor the family is informed when surgery is to be performed. Avertin is used so that the patient is asleep in his room and has none of the psychic trauma attendant upon his going to the operating room.

7. A radical subtotal thyroidectomy is done.

8. Convalescence is not hurried since several months are required before the full benefit of subtotal thyroidectomy is obtained. Symptoms recur in from 10 to 15 per cent of the cases.

In all of his cases the author has never seen one with psychotic symptoms in which these symptoms disappeared completely. They sometimes are lessened for a very short period but have always recurred. Good psychiatric treatment is an aid but does not completely change the poor outlook.

EARL O. LATIMER, M.D.

Mitchell, N., and Angrist, A.: Focal Necrosis of the Adrenal Cortex. *Am. J. M. Sc.*, 1943, 205: 549.

Mitchell and Angrist collected 18 cases of focal necrosis of the adrenal cortex incidental to 3,080 autopsies at the Queens General Hospital, Jamaica, Long Island. All but one of the lesions were observed microscopically in a single paraffin-imbedded, H-E stained section of the adrenal gland taken at autopsy. The relevant associated clinical and pathological findings, and the histological features are outlined in separate tables. The lesions were recent in 12 instances, and were of the chronic type in 5. The acute changes were of 2 types. The first change consisted of the formation of variably sized areas of focal coagulation necrosis of the adrenocortical tissue, which were encountered mainly in the zona fasciculata. The other type of acute change was one of localized cytonecrosis of a varying number of individual cortical cells. Both changes are described in detail and are illustrated by photomicrographs. Giemsa and gram stain preparations on most of the acute necrotic lesions showed no virus inclusions or bacteria in situ.

On reviewing the literature, the authors noted that the causative factors commonly named in focal necrosis of the adrenal cortex were infection, toxemia, endocrine imbalance, and allergy. Eleven of their own 12 patients who showed recent changes had some infectious disease process. Diabetes was noted in 5 cases, 2 of them without attending infection. In 1 of the latter Cushing's syndrome was fully developed (diagnosis of basophilic adenoma of the pituitary gland was confirmed at autopsy), and in the other instance an eosinophile adenoma of the pituitary gland was observed. Two cases with infection showed cachexia, and 6 cases presented widely divergent extra-adrenal arterial and venous thrombosis. In 1 case of hypertensive cardiovascular disease neither an infectious process nor an endocrine problem was observed.

The multiplicity of factors noted has led the authors to the conclusion that focal adrenocortical necrosis is not a specific disease entity with a single cause. "A physiologic component in the production of necrotic lesions is indicated by the multiplicity of etiologic factors, the apparent significance of endocrine states, and the gradation of such lesions in size and nature with involutional physiologic changes in the adrenal, and the negative bacteriologic and virus findings."

In discussing these findings, Mitchell and Angrist suggest a possible relationship of adrenal necrotic lesions to Addison's disease and to the Waterhouse-Friedrichsen syndrome, and to intestinal ulceration.

EDWIN J. PULASKI, M.D.

EXPERIMENTAL SURGERY

Falconer, M. A., McFarlan, A. M., and Russell, D. S.: Experimental Brain Abscesses in the Rabbit. *Brit. J. Surg.*, 1943, 30: 245.

Of a series of 130 rabbits given a subcortical injection of human pathogenic organisms in a 2 per cent nutrient agar suspension, 63 developed definite abscesses, while the remainder developed diffuse inflammatory reactions.

Within forty-eight hours an established cerebral infection would either become circumscribed or would spread to reach the ventricles. In the latter case there was considerable edema with herniation and irregular areas of necrosis without a definite tendency toward limitation. The former type showed a somewhat similar process except that a definite leucocytic reaction was noticed and this was observed about the necrotic area and also part of the abscess. The organisms in the abscess group were always found only in the necrotic core.

The localized group, after forty-eight hours, showed a definite microglial infiltration which in about one week migrated centrally to begin obliteration of the necrotic area, particularly toward the cortical side. There was a cortical proliferation of the blood vessels with an infiltration of their adventitial sheaths, accompanied by intervascular formation of reticulum fibers.

By the third week definite encapsulation was organized into four distinct layers: (1) a layer of

foam cells surrounding the pus core and separated by a delicate reticulum-fiber framework, (2) a layer of lymphocytes, plasma cells, and occasional fibroblasts interspersed with more foam cells, (3) a coarser layer of reticulum fibers, fine collagen fibers and foreign-body giant cells, and (4) a glial reaction in the adjacent cortex.

After the third week there was only a consolidation of the capsule and progressive resolution of the abscess.

These responses were always markedly delayed in the part nearest the ventricle, i.e., the part of the capsule that is formed in the white matter. This accounts for an occasional loculation and daughter abscess formation.

The type of organism did not particularly change the type of encapsulation, and there was no retardation of encapsulation in abscesses caused by Gram-negative and anaerobic bacteria.

The injection of small amounts of thorotrast stimulated an earlier capsule formation, particularly in the ventral or dependent borders where the thorotrast had gravitated. The late-stage capsule was not appreciably changed, possibly due to the small amount used.

Sulfanilamide was used in a group of 13 animals with a similar control group. These animals were given 300 mgm. per kgm. in daily doses intraperitoneally for three days (2 animals for five days); however, there was no significant difference between the treated and control group.

In correlating their findings with clinical ideas, the authors point out that enucleation of brain abscesses as advocated by Vincent *et al.* should be done only after three months, for definite encapsulation could not be expected before, and even then it should be remembered that the deeper portion of the capsule might not be as tough as the superficial part. Their department practiced preliminary aspirations with decompression only if the intracranial tension was not relieved. It is suggested that thorotrast, besides being useful in roentgenological demonstration, might be useful in promoting capsule formation.

JACK I. WOOLF, M.D.

Thiersch, J. B.: Intrasternal Bone-Marrow Grafts of Fetal Organs in Man. A New Method Using Adrenal-Cortex Grafts in the Treatment of Addison's Disease. *Med. J. Australia*, 1943, 1: 249.

Animal experiments have shown that adrenal cortex can be successfully transplanted subcutaneously, intramuscularly, and into the ovaries, testicles, or kidneys, in frogs, rats, guinea pigs, rabbits, and cats. An attempt has therefore been made to transplant adrenal glands in patients suffering from Addison's disease, in order to substitute the lacking organ.

The transplantation of adrenal cortex from man to man has been attempted repeatedly. Successful grafts associated with improvement in the patient's condition over a long period of observation are few.

The high price of the adrenocortical extracts, lack of their supply in wartime, the patient's dislike of frequent injections and of taking sodium salts, and residence of the patient in the country led to the following experiments. In accordance with the example of other workers, fetal adrenal glands were removed aseptically from stillborn infants, and the cortices were sliced into small pieces (of the size of matchheads) and washed twice in normal saline solution. But while previous workers followed the technique of the animal experiments and implanted the grafts into the testis, kidney, subcutaneous tissue, and muscle, Thiersch chose the sternal bone marrow as the site of the implantation for the following reasons: (1) because an immediate good blood supply for the grafted tissue would be available in the trabecular meshes of the bone marrow; (2) because hypernephromas metastasize and grow extensively in bone marrow; and (3) because only the insertion of a sternal puncture needle would be necessary for the actual grafting—a minor operation, which is easily conducted under local anesthesia.

Two cases of Addison's disease in which sternal grafts of adrenal cortex were implanted are reported. In one, all the effects of medication with sodium salts and adrenocortical extracts were replaced and exceeded by the grafts over a twelve-month period. In the second case only temporary effects were noted.

J. M. MORA, M.D.

Ungar, G.: Experimental Traumatic Shock. Factors Affecting Mortality, and the Effect of Therapeutic Agents (Ascorbic Acid and Nupercaine.) *Lancet*, Lond., 1943, 244: 421.

This report embodies certain observations on traumatic shock carried out by a quantitative method on adult guinea pigs and rats in which the factors of hemorrhage, injury to vital organs, and sepsis were eliminated. Trauma, quantitatively measured, was effected by dropping a metal rod of known weight through a vertical tube onto the thigh of an animal narcotized by urethane. The trauma of energy input was expressed in kilogram-meters.

The authors found that the post-traumatic mortality rate depended on the energy input value which at 3.8 kg-m. was the average level for the production of 100 per cent mortality in guinea pigs. All subsequent experiments were therefore standardized at the latter level. It was noted that post-traumatic mortality was subject to seasonal variation, but was not due to the immediate experimental temperature conditions which were maintained at a constant level in all seasons.

Slight trauma preliminary to the standard trauma dose also reduced the post-traumatic mortality rate. This protective effect could be transmitted to other guinea pigs and animals of different species by the injection of serum obtained from the former shortly after the mild trauma. Ascorbic acid (from 100–500 mgm. per kilogram of body weight) when injected within fifteen minutes of the standard trauma dose also served to reduce the post-traumatic mortality rate. The injection of nupercaine (1:5,000 in saline solution) either locally or distant from the trauma

had the same beneficial effect as ascorbic acid. Procaine failed to show any protective activity and it therefore was assumed that this property of nupercaine was independent of its anesthetic action.

Post-mortem examinations of the control animals dead from trauma revealed hemorrhagic lesions in the stomach, lungs, kidney, and heart. In the animals protected from trauma by serum, ascorbic acid, or nupercaine, the number of hemorrhagic lesions on autopsy examination was significantly less than in the previous group.

BENJAMIN G. P. SHAFIROFF, M.D.

HOSPITALS; MEDICAL EDUCATION AND HISTORY

Arreguín, A.: A Reform in the Faculty of Medicine (Una reforma en la Facultad de Medicina). *Medicina*, Méx., 1943, 23: 59.

The author congratulates Argil on having brought about a change in the method of teaching in the medical school of the University of Mexico. This change consists in having pathology taught, not by the medical faculty from textbooks and in laboratories at a distance from the hospitals in which the students are working, but in immediate connection with the clinical cases that they are studying.

Naturally the suggestion of such a change produced a great deal of discussion and it was argued that the students would never in their clinical work see cases of all the diseases of which they should know the pathology. However, the author argues that it is much better for them to know the pathological pictures in the commonest diseases which they will meet in everyday practice and to have them related intimately in their minds with the clinical pictures than to have a much larger number of pathological pictures in mind without any relation to clinical cases. Book knowledge is dead knowledge but knowledge acquired on the hospital ward in immediate connection with the sick individual is living and useful knowledge. AUDREY G. MORGAN, M.D.

Whipple, A. O.: A Study of the Results of the Examinations in Anatomy by the American Board of Surgery. *J. Ass. Am. M. Coll.*, 1943, 18: 185.

As a result of the examinations in Anatomy, by the American Board of Surgery, Whipple draws the following conclusions:

1. Many of the candidates coming up for examination after five years of surgical training have either not had satisfactory instruction in gross anatomy or have forgotten what they knew.

2. In their earlier studies in anatomy the candidates were not instructed in the relative importance of certain structures as compared to others.

3. The candidates have not had an opportunity in their graduate work to study regional and applied anatomy in relation to surgical procedures.

It may be said fairly that the medical student in his first year is not being trained to be a surgeon. With equal fairness it may be said that he is not given proper instruction as to the relative importance of some structures as compared to others. The author makes one suggestion for the curriculum committees of our schools: give to the third- or fourth-year student, during the quarter or trimester of the surgical clerkship, a course in regional and applied anatomy in which an experienced surgeon can point out the relative importance of anatomical structure and function with the assistance of the surgical residents of the hospital or hospitals connected with the medical school.

J. M. MORA, M.D.

Slemons, J. M.: A Crosslight on Doctor Holmes and His Investigation of Childbirth Fever. *West. J. Surg.*, 1943, 51: 165.

Oliver Wendell Holmes was thirty-three years of age when in April, 1843, he became convinced that the evidence he had collected was ample, and its presentation suitable for publication as an essay entitled, "The Contagiousness of Puerperal Fever." Not the sufferings of his own patients—it is doubtful if he ever took an obstetrical case—but the mournful results from time to time in the practice of friends stirred his deep interest in the "dark obituary calendar" of certain obstetricians. Boston, too, had its epidemics of childbirth fever.

To the logical mind of Holmes, sifting recorded facts, it became clear that the disease was contagious, preventable, usually a reproach to some individual other than the patient. Emphatic need for precaution there was, particularly for strict cleanliness of the hands, if one would render service to women during labor. This subject filled his mind, and sooner or later his ideas must have found utterance. But what brought about the event?

Slemons believes that the stimulus may have been the work of Elisha Bartlett upon the difference between typhoid and typhus fevers, a difference which Bartlett established by a careful consideration of the facts available, without much personal contact on the part of Bartlett with either of the diseases. Slemons bases his opinion upon a letter from Holmes to Bartlett dated November 5, 1842, in which Holmes expresses great admiration for the manner and execution of Bartlett's attack upon his problem.

". . . The thorough manner in which you have exhausted the old and the recent authorities on the subject; the cautious crosslights you have brought to bear on their evidence; the justice with which you have weighed their value as medical witnesses; the close array of facts which you have brought together without pedantry and condensed without obscuring; the perfect system, clearness, and simplicity that run through your whole exposition of facts, and as it seems to me, the justice of your conclusions render your essay, in my opinion, a model among philosophical treatises. And although you claim to have done little by direct personal observation of the diseases on which you have written, very few among those whose opportunities have enabled them to collect the facts you have employed, would have

been able to combine them and educe their meaning as you have done. The talent for marshalling large masses of facts and directing them to their true aim is to that of the mere observer like that of the general as compared with the abilities of the common soldier; and as it seems to me, is not always estimated at its true value. . . ."

Plainly, the faithful summary of Bartlett's merits describes exquisitely the later accomplishments of Holmes himself, writing upon an obstetrical subject. Reading Bartlett's book supplied the impetus needed to finish his own task, not altogether different.

There is a marked similarity in the tactics these men employed in attacking their separate problems, and in conquering them. Note, the reference to assimilation of undigested material, to old and recent medical literature, to the justice displayed in weighing evidence—qualities equally pertinent to the character of Holmes and his work. Both authors used the same model of exposition, and apologized for a lack of direct personal observation of the phenomena they discussed. Both appealed to the medical profession not to accept authority blindly when cold facts were at hand, not to guess when one could be certain. DANIEL G. MORTON, M.D.

MEDICAL JURISPRUDENCE

Dodd, E. M., Jr.: Contracts Not to Practice Medicine. *Ann. Int. M.*, 1943, 18: 618.

A long established and still vigorous doctrine of the common law—the doctrine that contracts in unreasonable restraint of trade will not be enforced by the courts—has prevented enforcement of certain contracts not to practice medicine.

A number of tests are accepted by most courts in deciding the validity of contracts by the Seller of a practice not to compete with the Buyer. Those courts, unhampered by statute, have held the contract valid if the restraint of trade is no wider than the business, and is reasonably restricted as to area. Another test is in regard to time limitations; most courts would uphold a contract if limited to a reasonable time, and most courts hold that no time limitation is necessary.

The purchaser's remedies include the ordinary remedy for breach of contract—an action at law for damages. Since this is a limited action it is an unsatisfactory one. A much more effective remedy is an injunction against the continuation of the wrongful competition. This action can be obtained, in those states which adhere to traditional procedural methods, only by bringing a suit in equity.

Implied agreements not to compete are usually upheld by the courts with respect to a sale of a medical or other professional practice if it approves the geographical limits expressly stated in the contract.

In contracts by a physician or dentist who is employed by another not to compete with the latter after the termination of the employment there is a wide variation among courts with respect to their general attitude. If the contract is unreasonable it is held invalid. The interests of each of the parties to the contract and also the public interest must pass the test of reasonableness. The competition of assistants upon their termination of employment would take advantage of relationships with patients established during the employment and by means of the employment. Such competition will apparently be enjoined, unless the contract is found to be of unduly broad scope. However, contracts of this sort are not contracts in which public-spirited members of the professions can take pride, since the profession should maximize community service rather than maximize profits.

Contracts by partners not to compete are almost always held valid and are enforced by means of an injunction.

Judicial hostility to agreements in restraint of trade would undoubtedly make a promise by a doctor or dentist not to practice his profession invalid, when such promise was unconnected with the sale of a practice, with an employment, with a partnership, or with some similar type of association. When the person to whom such a promise is made is a purchaser of a practice or an employer or partner of the promisee, the agreement is almost universally found to be reasonable and lawful.

JOHN E. KIRKPATRICK, M.D.

Merritt, H. H., and Solomon, H. C.: The Relation of Trauma to Syphilis of the Nervous System. *Ann. Surg.*, 1943, 117: 623.

The authors discuss the relation of trauma to syphilis of the nervous system. Case histories are presented and the disease is divided into three clinical groups: (1) meningeal, (2) vascular, and (3) parenchymatous.

In the first group, or meningeal variety, 2 cases are presented which appear to present some correlation between the injury and the onset of the luetic meningitis. The first was a twenty-seven-year-old male who after a fight presented the typical signs and symptoms of luetic meningitis. Six months before the onset the patient admitted the appearance of a chancre and a secondary skin rash. The condition cleared rapidly with the exhibition of antiluetic therapy. The second instance was that of a forty-two-year-old male who after an automobile accident was unconscious for an unknown interval and suffered a fractured leg. Following hospitalization he suffered severe headaches and finally after several months the headaches were associated with nausea and vomiting. Serological tests confirmed the presence of syphilis and the condition cleared with antiluetic therapy.

In the opinion of the authors the trauma in the first case was too mild to initiate the full-blown picture of meningeal syphilis; however, the second case presented a definite correlation between the injury and the precipitation of meningeal lues. It is pointed out that in order to establish such a relationship between trauma and the initiation of meningeal

symptomatology the following criteria must be fulfilled: (1) a primary lesion well in advance of the injury; (2) cellular and serological normalcy of the spinal fluid immediately following injury; (3) the development of symptomatology from one to eight months following injury, and (4) the presence of cellular and serological evidence at the time of symptomatic onset.

In so far as vascular neurosyphilis is concerned, the authors are of the opinion that the trauma affects the already weakened diseased vessels. A patient of thirty-seven years who was struck in the head with a baseball, which resulted in a skull fracture, fell to the floor unconscious eighteen days after hospitalization. Following this the patient was paralyzed in the left arm and leg and the blood pressure was normal, although syphilis was evident from the immunological and microscopic examination of the cerebrospinal fluid. Here again the afore-mentioned points apply in correlating the injury and the initiation of the luetic manifestations which were vascular in origin.

There were 3 cases of parenchymatous neurosyphilis reported, 2 of the paretic variety and 2 of the tabetic variety. The patients in the paretic group had head injuries that following the accident showed clinical and laboratory findings consistent with paresis. In 1 instance the patient gradually developed into a typical paretic over eight months of time, and in the other, normal mentality was never regained following the injury, which had resulted in immediate unconsciousness. The third case was that of a man who fell from a scaffolding and suffered a short period of unconsciousness and thereafter progressively showed signs of mental deterioration so that after forty-five days following injury he was abmitted to a mental institution. Lues was demonstrated both clinically and chemically. In this latter instance the court allowed that the injury did "cause or accelerate the onset of paresis."

Two cases are recorded in which the appearance of tabes seemed associated with injury. The first was that of a head injury in which the court allowed the claim, and the second was that of a middle-aged male who demonstrated urinary retention following spinal anesthesia. ROBERT LICH, JR., M.D.

Gilbert, J. B.: Medicolegal Aspects of Trauma and Malignant Testis Tumors. *N. York State J. M.*, 1943, 43: 939.

The author presents cases of traumatic injuries to the testis as causes of tumor with the following conclusions:

Trauma does not cause cancer, but may accelerate its course. Exact diagnosis, being difficult, is not often made by the first examiner. Litigation cases, in general, have been inadequately examined and reported, and claims have been settled on the basis of sympathy, not science. From available printed records no conclusions can be drawn between the etiological relationship of trauma and cancer of the testis, but all present evidence is against this assumption. J. SYDNEY RITTER, M.D.